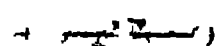
Practical Photography:

BEING

THE SCIENCE AND ART OF PHOTOGRAPHY, DEVELOPED FOR

AMATEURS AND BEGINNERS



ILLUSTRATED



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CHAPTER I

INTRODUCTORY—WHAT IS PHOTOGRAPHY?—LIGHT AND ITS COMPOSITION—ACTINISM OR RAY FORCE—A SIMPLE EXPERIMENT—A SENSITIVE MATERIAL—WET COLLODION

IN this and following chapters it is my intention to give in detail an instructive and, as far as is absolutely possible, an exhaustive account of practical photography in all its various branches At the outset I must call attention to the title of this book I have used the term "practical" advisedly I disclaim all ideas of entering on any long historical preface, however interesting that might be I am sure that all intelligent readers who study these "practical" instructions to their end will have at least sufficient enthusiasm to supply such ornamental *addenda* for themselves Nor do I hold forth any hope of giving what is now-a-days the fashion to call "æsthetical commentary" To those who can really appreciate the beauties of so fascinating an art and study as photography, such superfluities will be unnecessary, to those who cannot, they are useless After this curt and egotistical introduction, I shall at once enter into my subject, and proceed to give practical and straightforward instructions, by the careful observance of which an intelligent beginner may soon attain, not to mediocrity, but to excellence, which is the true goal and resting place of all the fair pursuits which we possess

To begin, then, what is photography? Photography is the art of writing or producing pictures through the agency of light The name is derived from two Greek words, the one signifying "light," the other "writing" or "engraving."

Simple as this definition may seem, it is useless without some explanation. This explanation is required by the word "light," which in this case is a general rather than an accurate term. To show this I must commence by a short preface on "light" and its composition. Light, as every one knows, is a powerful element in Nature; it is composed of rays of different colours, each of which performs a distinct individual function. Thus the red or orange ray has a calorific or *heating* power; the yellow possesses an *illuminating* influence; while the *chemical* power, which is instrumental in producing light pictures lies in the blue or violet ray. The thorough comprehension of these simple axioms is the key note to every branch of photography. The profit arising from it will be perceived as the student penetrates deeper and deeper into the mysteries of the art. For the present all that can be gathered is that the prime mover in the so-called art of photography does not exist in light generally, nor even in its illuminating power, but solely in its chemical influence; this chemical influence or property is technically known as "actinism," a term which is derived from a Greek word signifying a "ray," and which may be freely rendered into the English combination, ray-force.

Photography (more correctly actinismography), then, is the art of producing a picture through the agency of light, or, better, through that of "ray force," which is the chemical or photographic element in light.

From this theoretical preface I will proceed to find a material on which this "ray force" is to act, and so by the help of a camera and lens, and a convenient medium, such as glass or iron, to produce a photographic picture or image. If an ordinary plate of glass is exposed to any actinic light, however strong, of course no change will take place. The object, then, is to find a material which, when spread over the surface of the glass, will be susceptible to the actinic element in ordinary day light. A simple experiment, if carefully performed (for nothing is more simple, and at the same time requires more care than photography) will give at once a suitable material, and will, moreover, furnish an excellent illustration of what I said above on the composition of light.

Make a small box with a small hole in it, say about 2in square; besides this one hole there must be no aperture whatever capable of admitting light. Next procure from any chemist a weak solution (in distilled water, otherwise a milky precipitate will at once be formed, which will detract from the distinctness of the experiment) of nitrate of silver, and a weaker solution of iodide of potassium. Take the box and the two bottles into a darkened room, and by the light of a candle (for there is very little actinic power in a candle flame), pour the iodide of potassium solution into that of nitrate of silver; almost immediately a dense formation will take place. This formation, chemically known as a

precipitate, which is produced by the coalescence, in a certain degree, of a solution of iodide of potassium with one of nitrate of silver, partakes of the nature of both its components, and is hence called iodide of silver.

Put the bottle containing the precipitate into the box, and cover the aperture closely with a piece of orange or yellow glass, or even with silk or paper of those colours Sally forth from the darkened room, and place the box, with the bottle inside, in the sun After it has remained there for a few minutes take it back to the darkened room It will be found, if the glass or paper has not been moved, that no change whatever will have taken place in the colour of the precipitate Now remove from the aperture the covering which has thus been proved to be *non-actinic* (that is, impervious to ray force), and sally forth once more After a few seconds' exposure in the sun the precipitate will turn a rich brown, and if longer exposed to actinic light, will become almost black This result will establish three most important conclusions

(1) That there exists in light an actinic element which is capable of producing an impression on certain chemical substances ,

(2) That if this actinic element is impeded by, or absorbed in, an orange or yellow medium, its photographic or chemical influence is rendered null and void ,

(3) That amongst the chemical substances on which actinic force has power to act is iodide of silver Hence that iodide of silver is a susceptible or *sensitive* material

It will, however, be perceived that although an important stage in the rudimentary principles has been mastered, the sensitive material cannot be applied in this crude condition to the glass plate on which the image is to be impressed A careful preparation will have to be made, which, from the vessel in which it is contained when in use, is called the *sensitising bath* The principle on which it will be prepared has already been laid down the actual formula will be given in its proper place Again, granted even that the sensitising bath is already prepared, the plate cannot be sensitised without the aid of a substratum to cause the iodide of silver to adhere tenaciously to the plate The substratum used in the process which, while it is the first and simplest of all, is the one in almost universal use, is a fluid called *collodion* The glass plate is coated with the collodion, which is allowed to set but not to dry It is then immersed in the bath, in which it is sensitised and made ready for exposure in the camera

From this summary of the process it will easily be seen what part collodion plays in the preparation of the plate The ordinary process, to which I allude above, from the fact that the collodion is not allowed

to dry before immersion in the sensitising bath, is called a "wet collodion" one, in contradistinction to the various "dry plate" processes, which will be fully discussed in future chapters For the present "wet collodion" will deservedly occupy the amateur's whole attention, and will amply repay all care bestowed upon it by affording a wonderful certainty of result and uniform facility of operation

To begin with its manufacture collodion is gun cotton (pyroxyline), dissolved in nearly equal parts of ether and alcohol In old manuals of photography elaborate instructions were given relating to the manufacture of collodion by amateurs, but the idea has of late been abandoned Now that the collodion of the market is an article of real excellence in the hands of makers such as Mawson, Thomas, Blanchard, Huggon, and many others, it is worse than useless for an amateur to lay himself open to all kinds of unpleasant contingencies in the manufacture of what, in his hands, will be an inferior article at a very extravagant price Let him buy his collodion at any well-known repository, and he will be on the safe side He should not, however, make his purchase even of the first few ounces without some knowledge of its qualities and appearance

The first lesson to be learnt is that photographic collodion has to be *iodised* before it is ready for use This gives it the pale amber colour which good collodion ought always to have The amateur can either iodise it himself or purchase it already mixed Perhaps the latter course, being more convenient and only involving the expenditure of a few extra pence in as many shillings, will recommend itself to the luxurious unprofessional If, however, he is resolved to be independent even in this small matter, he must bear in mind that collodion newly iodised never works half so well as that which has been mixed for some time

This is the last "practical" suggestion I shall offer my readers in Chapter I The way to coat the plate with collodion, which is the first little difficulty which has to be encountered, will be described later on.



CHAPTER II.

Apparatus, with Descriptive Commentary—Requisite Chemicals and Formulæ.

In this chapter I shall give a descriptive list of the various apparatus required by the amateur in photography, together with some brief instructions as to the manner in which he should make his purchases before commencing actual practice. I have striven to make my remarks, especially those on the subject of purchase, acceptable to all classes of readers alike. Moderation is the golden mean between extravagance and parsimony. In photography the latter, as a rule, implies failure, while the former does by no means insure success. Taking moderation then as my general rule I shall endeavour to show how, by a moderate, but at the same time judicious expenditure, it is possible to procure a complete apparatus which will not only "do to learn upon," but will also in the hands of a proficient produce results to satisfy the most fastidious critic of the art.

In the first place, there are in photography certain fixed sizes, to the gauge of which almost all photographic apparatus is manufactured. The three principal of these sizes are quarter plate, which is 4¼in. by 3¼in., half-plate, which is 6½in. by 4¾in., and whole-plate, which is 8½in. by 6½in. For these there are certain French symbols, which are as follow: Quarter-plate is represented by ¼, half-plate by ½, and whole-plate by 1/1. As reference to these sizes is constant in things photographic, it will be as well to inform the learner that a quarter-plate camera is one, the dark slide of which is constructed to hold a quarter plate glass, and a quarter-plate lens is one that will produce an image on a sensitive surface of quarter-plate size, and so on. Finally, it is to the gauge of quarter-plate that the following instructions on the head of apparatus will apply.

The first question to be dealt with is that of the *Camera*, or chamber, into which the light is transmitted by the lens, before impressing itself in the form of an image upon the plate inside. There are several kinds

of camera, but they are all constructed on one of two principles, either wholly of wood with a "sliding body" for the purpose of focussing, or with an expanding concertina-like body of leather These latter, which from their lightness, are especially adapted for outdoor work, are called from their construction "bellows body" cameras In most cameras the expansion is effected simply with the hands, in others which are more finished, it is performed by a neat and handy screw adjustment This, however, is only necessary in cameras of very large size, and is hardly an advantage in taking pictures below whole plate A representation of an ordinary bellows body camera, complete with its slides and lens, will be found in Fig 1

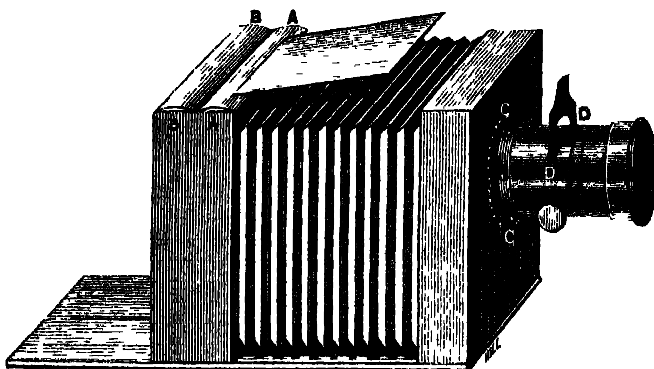


Fig 1 The Bellows Camera

The parts represented by A A and B B are occupied respectively by the dark slide and the focussing screen The latter is merely a sheet of finely ground glass, through which the operator scrutinises the object while adjusting the focus When in use, it occupies the space marked as holding the dark slide (A A), for it is of the utmost importance that the sensitised plate contained by the dark slide should be, during exposure, exactly the same distance from the lens as the focussing screen was during the adjustment of the focus Otherwise the foci would be different and the image on the sensitised plate would be as blurred and indistinct as it was on the screen before the focus was what photographers term "sharp" It must, moreover, be borne in mind, that the ground side of the focussing screen represents the sensitive surface of the plate, and must therefore be turned directly to face the object

The dark slide is shown separately in Fig 2 It possesses on one side a hinged lid, kept, when down, in its place by metal checks, to this is affixed a spring, which keeps the plate rigid during exposure, on the other it has a sliding shutter moving in grooves, also provided with a hinge and a piece of wood beneath it to prevent the shutter from sliding out altogether Inside the slide is placed a movable plate-carrier, with corners of silver wire After the preparation of the plate in the dark room the shutter is pushed down, the lid is opened, the sensitised plate is allowed to rest on the wire corners of the plate carrier, and the lid closed down to keep out the light, when the dark slide is in its place in the camera, the cap is placed on the lens and the hinged shutter is drawn up and allowed to lean forward, as in Fig 1 The cap is then removed, and after due exposure replaced, the shutter is pushed down, and the slide is borne off to the dark room to be developed Such is the construction and use of the dark slide The dark slide of an ordinary quarter plate camera usually contains two movable plate carriers, or, as they are sometimes called, inner frames, one to hold a plate of ¼ size, the other to hold a smaller one, 3½in by 2¼in (¼) A new ¼ plate bellows body camera of polished mahogany costs at a good "repository" from 25s to 30s

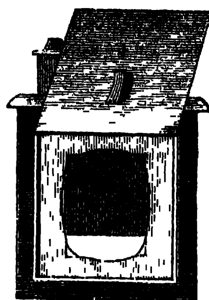


FIG. 2 THE DARK SLIDE

In front of the camera is fixed a brass flange (Fig 1, C C), into which is screwed the body of the lens The ordinary "combination" lens used for taking portraits consists of two compound achromatic lenses, mounted in a brass tube, with rack and pinion adjustment In most modern portrait combinations there is a simple and ingenious device by which the back lens can be taken out, and the front one, being reversed and screwed into the place left vacant by its companion, may be used for copying or taking views This is sometimes a great advantage, as it secures an image of the same size at about half the distance from the object required by a portrait combination In Fig 1, at the points D D, there is a slit cut in the tube containing the lenses, into which is inserted a piece of thin metal with a round hole in the centre These little perforated pieces of metal are most important items in photography, and from their inventor's name are called Waterhouse diaphragms or stops They are made with the centre holes of different sizes, and are employed to concentrate the rays of light in the course of their transmission through the lens They thus bring objects into focus which,

without their assistance, would otherwise form a blurred and unsightly foreground, or would spoil the picture by making the background hazy and indistinct The chief thing to be remembered in their use is that the smaller the stop employed the sharper will be the picture, and the longer must be the exposure of the plate A good English quarter-plate lens, complete, with rack and pinion adjustment, and a set of Waterhouse diaphragms of different sizes, can be purchased for from thirty-five to fifty shillings Fair lenses, it is true, can be bought for much less, especially those of French manufacture, but it is as well to stipulate for "approval" before actual purchase in such cases The same remark applies to lenses procured promiscuously at low secondhand prices

After disposing of the two most important questions, viz , those of the camera and lens, I come to the tripod stand, which is used to support the camera when in use An ordinary ashen tripod with a solid round top may be purchased for a very few shillings, and will serve the beginner, for all practical purposes, quite as well as a more expensive one with movable legs, &c I shall take another opportunity for describing the very ingenious tripod lately invented and patented by Mr Kennett, as its price, which is 26s , will hardly bring it within the reach of a beginner

After this must be procured a focussing cloth of some dark stuff, which, if it be not within the limits of home resources, can be purchased of good quality for about half-a crown

The next indispensable is a number of glass plates of a size to suit the camera There are several kinds of glass employed by photographers, of which the best is "patent plate" A very good medium kind for beginners is "best polished sheet," of which a gross of plates of quarter size costs only 7s or 8s

The sensitising bath, with its case or stand and dipper, together with dishes, cups, bottles, rods, leathers, cloths, &c , &c , I shall, for the sake of convenience, consider as belonging to the "dark room and its appurtenances," a full description of which will form Chapter III

From these I must turn in anticipation to the process of printing from the negatives upon prepared sensitised paper For this will be required a few American pegs from which to suspend the paper while drying from immersion in the sensitising solution, also a pair of wooden forceps to keep the paper evenly immersed, and to remove it without using the fingers

In the actual process of printing, a few teak printing frames will be necessary Quarter-plate frames without glass fronts, may be bought for about a shilling a-piece

When their share in the printing is performed the negatives can be conveniently stored in white wood boxes made for the purpose, with

grooved sides, to prevent the faces of the negatives from being scratched. These boxes, which are very cheap (one grooved to hold fifty negatives costing but 2s), are handy also to keep the clean glass plates in before sensitising

A set of scales and weights completes the list of apparatus, which may be enlarged, or, perhaps (but to no great extent), cut down to suit the taste and means of the beginner

I shall now proceed to give a list of the necessary chemicals, together with formulæ, for the various requisite solutions These last should be carefully preserved, as they are easily forgotten, and from any unforeseen accident may be required at any time I also advise my readers to copy out on an imposing card the table of Apothecaries' weight, and learn it thoroughly, signs and all This course will save them much trouble in their future photographic career, and much waste of valuable time will thereby be avoided

In laying in a stock of chemicals for his photographic laboratory, there is only one course open to the amateur, and that is to get every article of the very best quality that the market will produce There is seldom any difference between the price of good and bad chemicals, the difference lies in the places at which they are to be purchased On this subject a word in season may save trouble and expense Local chemists should for the most part be eschewed, unless they are known to be in a large way of business and to deal only in first-rate articles a small chemist seldom keeps the more essentially photographic chemicals in stock, and perhaps keeps you a week in utter helplessness for want of two or three indispensable grains The advice conveyed in this may, of course, be overruled in the case of common every-day chemicals, such as carbonate of soda and several others, but the more important and essential ones, such as recrystallised nitrate of silver, &c, should be procured either at one of the many excellent photographic repositories, or from some large manufacturing chemist in town

The following is a list of the chemicals employed in the ordinary wet collodion process, in the order in which they will be required, together with most of the formulæ for the proper composition of the various solutions

Collodion, and its nature, I have already explained (Chap I) I have, however, omitted one point in connection with it which deserves to be mentioned In producing pictures upon glass there are two distinct features One consists in simply obtaining an image on the glass without any view of further utilising it except for the sake of ornament, this, as the glass is reversed, presents when framed a *positive* picture to the eye, and is called the positive process In the second process the

operator's aim is to procure a *negative* picture on the glass, which, by "printing," may be transferred positively to prepared paper Though the latter (since, from a good negative any number of photographs may be printed) is naturally the more attractive process, the amateur, as a rule, is supposed to confine himself for a short time to the taking of positives, in order to get accustomed to the various preliminary operations, which require some little practice In "positive" work a few of the requisite chemicals are different to those used in the negative process The first discrepancy arises in the collodion In former times the same collodion was equally applicable to both, but now that negative collodion is *bromo*-iodized to gain additional density, it is necessary to use for positives another and a special kind "Positive" collodion can be bought in any quantity at all the "shops" I would advise the amateur to begin by purchasing a small bottle of *positive* collodion, containing, perhaps, five fluid ounces, and two bottles of the same size of ready-prepared bromo-iodized *negative* collodion The first will serve him to waste in the mistakes of his apprenticeship, and the others with due care ought to last for some time An excellent all-round negative collodion is manufactured by Messrs Mawson and Swan, and can be bought anywhere for about sixpence per fluid ounce Many photographers prefer to mix it in equal quantities with that manufactured by some other well known maker, such as Thomas, but that is a point which lies entirely within the operator's discretion The collodion can either be kept in a corked or stoppered bottle, but care must be taken not to leave the bottle open for any length of time, as the ether is subject to rapid evaporation, and the liquid shortly attains the consistency of luke-warm glue The operator must also remember before pouring the collodion on to the plate to wipe off from the lip of the bottle all the refuse that from the evaporation of the ether has coagulated or set around it To obviate this last difficulty a handy stoppered bottle is sold, having a kind of second rim, which catches the refuse drops, and leaves the real mouth of the bottle quite clean and free from any coagulation

After the collodion I come to the Sensitising Bath, which is a question of very great importance The chief ingredient in its composition is, of course, *nitrate of silver* This should he bought "recrystallised," as it is in this state more fit for photographic uses than that ordinarily sold by local chemists The beginner should buy about three ounces of this somewhat expensive article, as it will be required frequently in future operations, such as renewing the bath, intensification, and sensitising the albumenised paper An ounce of *iodide of potassium*, and the same quantity of *nitrate of baryta*, should be purchased at the same time Of *glacial acetic acid* (solid at 50°) five fluid ounces had better be procured,

as it is used also in the developer, and is sometimes handy to rescue the bath from alkalinity Finally, a large bottle of *distilled water* will be required, which it is best to buy at the shops Instead of distilled water boiled rain water can be used with success

In the sensitising bath, as well as in the collodion, there is some difference in the formulæ employed for positives and negatives This it is as well to lay a stress on, if the amateur is going to make the positives a special study, but if he only takes it up, say for a week, to get his hand in, it is hardly worth while to prepare a separate bath, which will have to be thrown aside and prepared anew when negatives are to be attempted, especially when the negative bath, if properly manipulated, produces quite as good a picture as is required to show the beginner "how it is done," and to make him anxious for higher flights However, to please everyone, I give the following formula (the best I know of) for the

Positive Sensitising Bath.

Recrystallised nitrate of silver	½oz.
Distilled water .	8oz.
Positive collodion .	1 drop

Shake well and filter, add two drops of nitric acid, and the bath is ready.

The sensitising bath is kept, when in use, in a porcelain vessel specially made for the purpose When not in use it may be kept in a stoppered bottle A quarter plate bath contains generally about 8oz of the sensitising solution, which should be carefully made up according to the above proportions

The formula for the negative bath is somewhat more comprehensive, and is as follows

Negative Sensitising Bath

Sol I	Recrystallised nitrate of silver .	1oz
	Distilled water .	2oz
Sol II	Iodide of potassium	1gr
	Distilled water .	1oz.

Mix the two solutions, and shake until the iodide precipitate disappears, then add a solution of 2grs. of nitrate of baryta in 9oz. of distilled water, and filter carefully

When the plate has left the sensitising bath an important stage of the proceedings is completed The plate is then exposed in the camera, and after exposure is brought back to the dark room Apparently it has undergone no change whatever, but a very great and mysterious change indeed has in reality been effected The plate, through the action of light, has been impressed with an image which for the present is a

latent one This latent image requires to be developed, an operation which, in the case of *positives*, is effected by the following solution

POSITIVE DEVELOPER

Proto-sulphate of iron ...	**100gr**
Glacial acetic acid	**⅓oz.**
Spirits of wine	**½oz**
Nitric acid .	**4 drops**
Water .	**10oz.**

In the case of *negatives* by

NEGATIVE DEVELOPER

Proto-sulphate of iron ,	**¼oz**
Glacial acetic acid	**¼oz.**
Spirits of wine	**⅓oz**
Water	**8oz.**

For the developing solution, as it is in constant requirement, about ¼lb of sulphate of iron, together with 5oz or 6oz of spirits of wine, should be procured In time the developer becomes quite brown, assuming the colour of brandy, but this, if the developer is made up in moderately small quantities, effects no deterioration of the slightest consequence

With the application of the developer, if the exposure has been correct, the image gradually appears But it not unfrequently happens in *negatives* that the image after development is a weak one, lacking gradation and contrast, and exhibiting insufficient difference between light and shade This is open to be remedied by a process called intensification, for which a standard formula is—

INTENSIFYING SOLUTION.

Pyrogallic acid .	**10gr.**
Citric acid	**25gr**
Distilled water	**5oz.**

A portion of this is poured over the plate and allowed to drain back into the glass , it is then mixed with a few drops of a solution composed of

Nitrate of silver	**20gr**
Distilled water	**2oz.**

The amateur should buy English pyrogallic acid, as that manufactured in France is of inferior quality

After intensification comes what is virtually the last operation, and that is to *fix* the image so as to render it unassailable by the further action of light This is done by either of the two following

FIXING SOLUTIONS

I. Hyposulphite of soda	**4oz.**
Water	**5oz.**
Or	
II. Cyanide of potassium	**¼oz.**
Water	**10oz**

I myself prefer the latter, but it should be used with the greatest caution, it contains a large proportion of cyanogen (the chief component of prussic acid), and is a most deadly poison In positives it should be used in preference to "hypo," but in negatives the amateur may take his choice

After fixing, the positive should be varnished to prevent its being scratched The negative should undergo the same operation if it is a good one, and likely to be called on to furnish a large number of prints Spirit varnish, as adapted to photography, can be purchased anywhere at a small cost Five ounces will last for a very long time, as the surplus can always be poured back into the bottle like collodion

The above will be all that is necessary to take a good positive or negative When this is done all anxiety is over The paper printing in the negative process, though in itself important, is quite a secondary matter In fact, it is by far the best course for the amateur to send his *good* negatives to a professional printer, who will produce prints far better and cheaper than the unprofessional beginner Nevertheless, I should by all means advise the latter to familiarise himself with the details of the process, and to this end will give a list of the few chemicals, &c, he will require The formulæ I shall reserve for a further chapter, which will be entirely devoted to the art of producing prints on paper from negatives of all kinds

Naturally, the first question in paper printing is the paper This is to be bought ready *albumenised* or coated with *albumen*, the most general form of which is the white of an egg A quire of albumenised paper should be procured, and care should be taken to get it of good quality To sensitise it, nitrate of silver will be needed, together with an ounce of *kaolin* In toning the prints the chief agent is *chloride of gold* This is bought in little tubes containing 15grs An ounce of *acetate of soda* and the same quantity of *carbonate of soda* will be requisite To fix the print, *hyposulphite of soda* is used The last necessary will be a small cake of Indian ink, to touch up any spots in the finished print

Now that the apparatus and chemicals are disposed of, there only remains one more "rudiment," and that is the equipment of the dark room, which will form the subject of my next chapter



CHAPTER III

The Dark Room and its Appurtenances

What the library is to the student or the laboratory to the chemist the dark room is to the photographer. In it his operations are begun and ended; it is his workshop and storeroom in one. For this reason any imperfection in its construction or equipment may lay its possessor open to an almost endless train of difficulties and vexatious failures; while, on the other hand, a little preliminary care and judgment will insure a degree of comfort and success which any future additions or alterations will seldom bring.

To define a dark room technically, it may be said to be a chamber free from the ingress of actinic light, where certain operations in which actinic light ceases to be a useful agent and begins to exercise a destructive influence, may safely be performed. It will be necessary before selecting or constructing a dark room, and especially before furnishing it with suitable appurtenances, to enumerate what, in the ordinary wet collodion process, these "dark" operations will be. They are performed in the following order: (1) Sensitising the plate, and transferring it from the sensitising bath to the dark slide; (2) Development; (3) Intensification. And in the process of paper printing: (1) Storing the prints before trimming and toning; (2) Trimming, and toning them in the bath of chloride of gold. Keeping those five "powers of darkness" in view, let us consider in what kind of chamber, and with what appurtenances they may successfully and conveniently be dealt with.

Naturally its shape and position are the first points for deliberation. These for an amateur must nearly always be matters of circumstance. A professional would have his dark room specially constructed to adjoin his glass house or studio; but as the amateur's dark room is generally an ordinary chamber or outhouse adapted to a purpose for which it was not originally intended, and his glass house nothing more than a vision of the future, he must be content to waive the questions of shape and situation, and compensate for all exterior imperfections by extra attendance to interior comforts. If, however, he is fortunate enough

to be offered a choice, let him secure on the ground-floor (or, what is more reasonable, among the outhouses) an oblong room not less than 12ft long by 6ft broad. I have purposely named a large size, because it is my opinion that a beginner, especially in a delicate art like photography, should be always allowed plenty of room. It will be a long time before he can arrange his bottles and apparatus (to say nothing of his ideas) with anything like method, and by the time he has accomplished that, he will be seized with a frantic desire to attempt something new—dry-plate photography, the manufacture of emulsions, and the like. All this will require extra space, and if the space is not ready to his hand the impatient tyro will be plunged into confusion and despair. The photographer should remember also that compounds like collodion cannot fail to vitiate a too-confined atmosphere, and that a few square feet gained in compactness are poor substitutes for the loss of comfort and health. My own photographic *sanctum* comprises two rooms, one opening into the other. In the inner one, which is of considerable size, I collodionise and sensitise my plates; in the outer there is a tap and sink at which I develop, intensify, and fix. By this method I keep my inner room almost entirely free from dust and impurities, and ready at all times for any experiments I may wish to make. As a hint to brother-amateurs, I may remark that these two rooms were originally nothing more or less than the washhouse and ironing room of a laundry. The scene of my first attempts was an unoccupied harness room; this, however, I was soon forced to leave, from the absence of a sufficient and convenient supply of water, and from the presence of a most unnecessary supply of dust. Talking of dust, the first thing to be thought of after choosing a dark room is to render it as free as possible from this inveterate foe to photography. Cobwebs and all such abominations must be carefully removed, and never allowed to appear again. If the floor seems likely to give trouble, it should be covered with some smooth substance, such as ordinary oil cloth.

And now I come to the *lighting* of the dark room. This seems a rank Hibernicism, but careful readers will have discovered that darkness may certainly in this case be relieved by light, provided it be of a non-actinic kind. Yellow and orange glass, cloth, or paper can easily be obtained, according to the taste of the purchaser. The best place for the window in the ideal room I am describing is one of the ends; if the door opens into one of these ends, the window should be inserted by its side, about four feet from the floor. This, as will soon be shown, allows an oblique light to be cast on the plate during development, a process in which a good light is required to judge when it is complete, or whether intensification will be necessary. A square foot of ruby glass makes a

perfect window, which will give ample light, and, if procured of proper quality, be completely impervious to actinic force This glass should be fixed in a sash, and the whole window should be made to open like the port-holes of a ship Thus, while the plate is being sensitised, the fumes of the collodion can be allowed to escape, the same course can be adopted while fixing, if that operation be performed with cyanide of potassium in preference to hyposulphite of soda If yellow or orange glass is not used, a good non-actinic light can be obtained by pasting two or three thicknesses of orange paper over panes of ordinary glass

An excellent suggestion concerning the light of the dark room is offered in the Almanac of the *British Journal of Photography* for 1878, by Mr Werge, the proprietor of the well-known photographic repository in Berners-street His plan is to place over the orange or yellow light of the window a piece of *green* glass, which, while neutralising the unpleasant ocular effect which yellow and orange possess, does not interfere with their non-actinic property Those who are eternally flitting in and out of their dark room, as amateurs invariably do, will soon perceive the value of this sound and practical suggestion

Failing a window of any kind, a lamp or a candle may be employed, but the light should be mitigated by a non-actinic shade, especially when the plates are extra-sensitive

The *furniture* of the dark room is a very simple matter It should consist simply of a strong deal table, running, if possible, the whole length of the wall Underneath should be a common cupboard, in which stock solutions, &c, may be kept The stock solution of the developer may be made up and kept in a Winchester or a Corbyn quart, and the collodion either as it is purchased, or in tall bottles with narrow necks, so as to allow all impurities to sink to the bottom, and to prevent evaporation while decanting into the smaller bottle employed in every-day practice Hyposulphite of soda and other crystals should be kept in saturated solutions, so as to be ready, by merely adding water, for immediate use Cyanide of potassium, for fear of accidents, whether in solution or otherwise, should always be kept in a distinguishable bottle and clearly labelled "Poison"

At the end of the table, directly under the window, there should be fixed a sink, at which, after exposure, the plate can be developed and washed A good plan is to have this made of porcelain, with a plug ground to fit the waste pipe. The sink can then be used for washing prints and other incidental operations, it will be especially useful, as will be seen, in dry-plate and Autotype work In the middle of it should be placed a small basin, which will serve a double purpose first, to rest the plate on during washing and to afford relief to the

fingers secondly, to serve as a receptacle for the residues of silver in the p sses of development and intensification These residues, together with odd slips of sensitised paper and other scraps contained silver or go can be disposed of to professed assayers, and a marked saving realised by the economical operator Above the sink should be an ordinary, gently running tap. If water is not laid on, a jug can be employed, or what is better, a filte placed on a strong shelf a little over the sink The waste can be led away to a tub or bucket, which, when full, can be carried off and replaced empty Around the sink should stand the developing, intensifying, and fixing solutions, together with the measures into which the first two are respectively poured before they are flowed over the plate For the developer a 1oz measure and a funnel of the same capacity will be required, for the intensifier, a smaller measure to contain, say, half a fluid ounce, will be necessary If cyanide be used for fixing, it can be poured on from the bottle, if hyposulphite be preferred, the solution should be prepared and administered in a dish

At the dark end of the table should stand the prominent feature of the operating room—the sensitising bath This can be of glass, porcelain, or ebonite It may rest in an oblique position, either on a stand or in a case with a cover to keep off the dust A porcelain bath, with a lip, in a plain deal case, is perhaps as well fitted for a beginner's room as a more expensive air tight one in a polished and brass-bound case of mahogany

The plate is let down into the bath by means of an instrument called a dipper The best dippers are made of pure silver, but one of common glass, fluted to prevent capillary attraction, will, for all practical purposes, be amply sufficient Near the bath should stand the collodion bottle, and one or two sheets of blotting paper on which to drain the sensitised plate before transferring it to the dark slide

On the space between the bath and the sink may be placed the chemical chest, together with a few incidental necessaries in the way of apparatus, &c Two or three porcelain dishes will be required in the process of paper-printing, also a few glass rods for stirring Filtering papers *ad lib*, with a small pestle and mortar and a spirit lamp are always being wanted Dusters the operator must please himself about, but he must take care they are clean and always ready to his hand He must remember also to procure a soft chamois leather and a camel's hair brush for cleaning the plates

With these minor "appurtenances," which each person must regulate according to his taste and requirement, I will end the present chapter



CHAPTER IV.

Commencement of Operations—Positives on Glass—Pouring on Collodion—The Plate Sensitised—The Final Focus—Exposure—Development—Fixing, &c

The object of the instructions which have preceded this commencement of operations has been to prepare my readers both mentally and materially for the results, to which it will henceforth be their object to attain These prefatory instructions are now complete, and the time has come to put their reliability to the test of actual practice, and suggestions relating to the purchase of apparatus or chemicals will now be succeeded by a detailed account of their use and of the results which they unite to procure

I have already explained (Chapter II) that photographic pictures are of two general kinds, positive and negative The former of these being, as I remarked at the same time, the one on which the beginner usually tries his "'prentice" hand, my first object shall be to teach him how to produce a positive picture This again may be accomplished in two ways: either with the help of a glass or a metal plate Positives on metal are called *ferrotypes*, and will receive special mention shortly For the present, I shall describe how to produce a positive image on a prepared plate of glass

Before attempting the operations, let the operator assure himself that he is thoroughly prepared to carry them out without intermediate delay Let his dark room be neat and as free from dust as possible, his bottles and apparatus methodically arranged and ready for use, and his solutions carefully made up and distributed in their respective vessels The slightest speck of dust must not appear on his lens or be allowed to hover in the inside of his camera In fine, every implement he is about to employ should be scrupulously clean and in its allotted place

The photographer's next care should be the object on which he is resolved to exercise his skill His, her, or its position is a matter of great importance, which will have a material effect on the finished

picture The question of "pose," however, depends so much upon the appearance and firmness of the sitter, that I must leave it altogether to the operator's discretion and artistic taste Perhaps an occasional look through an album of high-class portraits, and a comparison between them and his own attempts in this line, may benefit the beginner far more than any general rules With regard to the "situation" of the object, if the performance is to be conducted in the open air, I can recommend no more useful "property" than a common garden seat, constructed of rough-hewn logs, which, from its unstudied appearance and freedom from artificiality, has always a pleasing effect The question of "lighting" is not so important in the positive as in the negative process, where the delicate paper-print is especially sensitive to effects of light and shade There is one mistake, however, that must particularly be avoided, and that is working with the sun in front of the lens, if not at the operator's back, it should be at his side, but never shining in his face Windy days should be eschewed, as a disturbed ribbon, or even lock of hair, may frequently spoil a picture

I will suppose now that the object is gracefully, appropriately, and conveniently posed, and that at as nearly a suitable distance as can be guessed, the camera and lens, resting on their tripod stand, are directed towards it It is now time to obtain the general focus Insert in the groove shortly to be occupied by the dark slide (which should have been left meanwhile in the dark room) the focusing screen, and throwing the focusing-cloth over your head and shoulders, scrutinise the object carefully through the ground-glass plate If necessary, move the camera and tripod backwards or forwards, as the case may be, until some sort of image is apparent To obviate the troublesome delay that this usually causes the beginner, it is a good plan to focus the seat carefully before the sitter is called upon to occupy it When the image is about the size required, complete the general focus by moving either the sliding or bellows body of the camera until the object is as distinct as possible This will do for the present, and, cautioning the sitter to make no material movement in the position you have determined upon, you can now retire to the dark room to prepare the plate

On reaching the dark room, you must take especial pains to clean the glass plate which you are about to use for the picture There are innumerable formulæ for plate-cleaning solutions, all more or less efficacious, which the amateur can adopt or not as he pleases For myself I find that first a thorough rinsing under the tap, and then a little alcohol or dry tripoli powder well rubbed on and off with a piece of chamois leather, or a clean handkerchief, will brighten the most obstinate plate, provided it be of good quality. After whisking off with a camel-hair

brush any minute particles of dust that may have settled on the plate, it will be ready to be collodionised

A correspondent, an old amateur, sends me the following particulars of his plan of plate cleaning, which, he says, he has, in a lengthened experience, found to answer admirably —"Take, say, a dozen or any number of plates, and, after rinsing and washing them well in hot water, rubbing them the while with a piece of rag, place them for a few hours in a weak solution of hydro-chloric acid, I usually leave them in this a night This done, mix some whitening with water, to the consistency of Devonshire cream Take a plate out of the acid solution, just dip it in water to remove the acid, then, with the finger or soft brush, daub on the whitening, cover both sides of the plates and the edges with this material It should be laid on just thick enough to cover the glass, but too much is better than too little Now stand, or rather lean, the plate against a wall on a shelf or any other convenient place, out of the dust, to dry. All the plates are to be treated in the same way, and laid aside to dry When perfectly dry they may be put together and wrapped in paper, where they are left till wanted. When a plate is required for use, gently rub off the whitening with a clean soft rag, or a piece of soft paper will do Rub it off the edges the same way, being careful to touch the plate no more than is necessary with the fingers The whitening is removed in half a minute, and when this is done you have only to give the plate a little gentle polishing with a clean chamois leather, or a piece of cotton wool It will then be found that the plate has a beautifully clean and highly polished surface. If a sprinkling of the whitening be left on the plate, the gentle application of the chamois or cotton wool will remove it. The advantages of cleaning the plates thus may be summed up as follows Any number of plates can be cleaned and coated with the whitening days, weeks, or months before they are wanted for use, when wanted they can be made ready at a minute's notice, and when ready they are thoroughly clean. It is very advantageous, too, not to have to moisten the plates just before collodionising"

Pouring on the collodion is a difficulty which the beginner needs some little practice to overcome, and as such requires some explanation. Those who have never seen it properly performed will learn more readily from the accompanying illustration (Fig 3) than from any description, which from its prolixity would be confusing

Taking, then, the wood-cut as a reference, proceed as follows:—Hold the plate level by the corner (A) between the finger and thumb of the left hand; from the bottle in the right hand pour a stream of collodion which you judge to be of sufficient volume, when spread, to cover the plate

with some small surplus Let the stream fall on the plate between the corners B and C, at a point inclined to the centre, E Tilt the plate slightly to allow the deposit to flow to B and C, to prevent its running over the edges, again tilt it, this time towards the hand which holds it, and let the collodion flow down in a steady stream to the corner (A), then, before it has time to touch the thumb, tilt the plate a third time and let the surplus run off from the corner D into the mouth of the bottle held to receive it in the right hand as before As the surplus collodion flows back into the bottle, rock the plate slightly to prevent the thin film which remains from setting in "crapy" lines upon the plate With a very little practice the whole of this operation can be performed with great dexterity, and without wasting a single drop of collodion, in a fraction of the time it takes to describe it

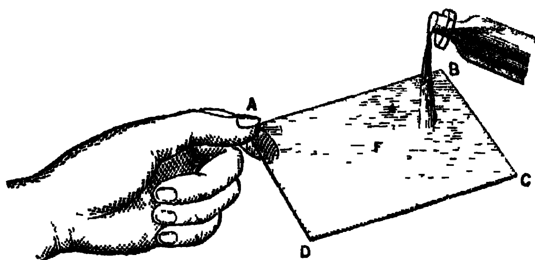


FIG. 3. POURING ON COLLODION.

If the collodion be poured from any but a "cometless" bottle, before pouring, the finger should be passed round the mouth to clear away the refuse which has, from the speedy evaporation of the ether, set round it either since the last pouring or during the decanting from the stock bottle to the one in everyday use

When the collodion is set (but not dry) in an even film all over the plate it is ready to be sensitised in the sensitising bath Holding the plate still by the corner between the finger and thumb of the left hand, remove with the right the cover from the case containing the bath and dipper Pull up the dipper and let the plate rest, collodion side upwards, upon the ledge at the bottom, then plunge the dipper with the plate resting upon it slowly and steadily to the bottom of the bath Be particularly careful not to hesitate for the tenth part of a second in the downward movement of the hand which lets down the plate into the bath. If you do, the plate will not be evenly sensitised, and a line will be seen across the plate at the point where the movement was stopped

When the end of the dipper safely rests on the bottom of the bath, put on the cover and rest from your exertions If you find the fumes of the collodion too powerful, open the window and take a good breath of fresh air When the plate has been in the bath about a minute, take off the cover and gently move the dipper a few times up and down This will cause a disturbance of the solution and prevent greasy lines from forming on the film Again put on the cover and prepare the dark slide for the reception of the sensitised plate If the slide is not specially made with a groove to allow the plate to drain, it is best to place small pads of blotting paper over the two lower silver wire corners of the plate carrier When this is done, and the plate has been in the bath from two to four minutes (according to the heat or coldness of the weather), lift up the dipper, and taking the plate by the corner at which it was held before, lift it off and allow it to drain on to a piece of blotting paper The dipper may be returned to the bath and the cover replaced to exclude all dust When the plate has been drained it should be transferred to the dark slide, the corners of the plate resting upon the corresponding corners of the plate-carrier The lid of the slide, which is fitted with a spring to keep the plate rigid and in its place, is now shut down, and the plate is ready for exposure

When the lid of the dark slide has been closed down and prevented from suddenly opening by the adjustment of two metal checks, the plate can be carried with impunity into the open light to await exposure in the camera. If, however, the sun be very powerful, the slide should be carried under the coat or wrapped up in the focusing cloth The operator should also take care not to allow the shutter to slip, and so to give entrance to a current of light

When the spot where the camera stands is reached, the slide should be set down, and the final focus secured If the sitter has made no material movement since the general focus was obtained, and the image is still distinct, this can be done by manipulating the rack and pinion adjustment of the lens until the image is perfectly defined and "sharp" in the part or parts which are to be reproduced If it is desired to obtain a full-length portrait or the reproduction of any object the distances of which, when viewed through the screen, are not equally "in focus," a diaphragm or "stop" should be inserted between the lenses, to concentrate the light and to render the foreground and background of an object as clear (in reasonable proportion) as the object itself If rapidity is required, and perfect definition is of no great consequence provided a good likeness of any particular portion be obtained, a diaphragm (or at least one with a very small perforation) need not be employed, as, while its use increases the definition, at the same time it adds to the necessary length of the

exposure The "stop" can also be dispensed with in taking vignettes or head-and-shoulder pictures, but in full-lengths, groups, and landscapes, it will be found in the case of ordinary lenses, an invaluable addition

When the focusing is fairly settled, the focusing screen can be drawn out and set on one slide, and in the groove left vacant by it the dark slide inserted* Now, supposing the cap to be still on the lens, steadily draw up the shutter of the slide and allow it, when the hinge is reached, to lean forward towards the lenses If the light is strong, it is as well to perform this operation under cover of the focusing cloth, as the opened hinge frequently forms a chink by which the outer light can freely enter Caution the sitter to remain quite motionless (except as to his or her eyes, which should be blinked freely, otherwise a fixed and unpleasant stare will be the result) and remove the cap as quietly as possible from the lens

On the question of exposure I can give no fixed instructions Length of exposure varies as the light varies at six o'clock in the morning and six in the evening, in the murky fog of November and in the brilliancy of July It depends, moreover, on the kind of lens or lenses employed, double combinations working with about twice (and often, as in the case of quick, large aperture, "baby" lenses, with very much more than twice) the rapidity of single ones I can, however, offer one suggestion, and that is for the operator to determine finally the time he intends to expose his plate before he removes the cap from the lens, and when it has expired, let him not be troubled with any misgiving that the time has been too long, or be deluded by the idea that another moment will make no difference, but as the last second is counted, let the cap be replaced on the lens When this is done the exposure is over, and the shutter of the slide may be shut down. The dark slide itself should now be drawn out and conveyed to the dark room to undergo the process of development

Before opening the slide in the dark room, the operator should assure himself that there is in it no aperture or chink, however small, affording entrance to white light If such exists it should be promptly and effectually covered up, if it be allowed to remain, the plate will probably be covered with "fog" (a visitation which will be described and discussed in a future chapter) and rendered utterly useless Next a small portion of the positive developing solution should be allowed to filter through a funnel fitted with a filtering paper, into the measure specially set apart for it The lid of the dark slide can now be opened and the plate removed Care should be taken not to rend the film with the fingers, but to hold it throughout this and succeeding operations in one place, namely, at the corner at which it was held during the pouring

on of the collodion When the plate has been removed from the dark slide, no change from its condition before exposure will be perceived The real change which has been effected is the impression of an image now latent; the object, then, is to make by development this latent image a visible one. To this end remove the funnel through which the solution has been filtering from the measure, and pour from the latter enough of the positive developer to cover the plate scantily without surplus Do not allow the solution to run over the edges, but, by gently rocking the plate, allow it to flow to the corners, and by degrees to act upon the whole surface of the film. In a few seconds, if the plate has been properly exposed, and the operations have been throughout correct, the image will begin gradually to appear, in the reverse tint to that which they exhibit in nature. Thus a white collar will seem black and a black coat white Moreover, as those parts of the picture which are in nature of a light tint, are those most powerfully acted upon by photographic light, the first object developed on the plate will appear a deep shade, and will represent what is light in the natural object. This reversion of light and shade is, however, only apparent when the picture is held up and looked through against a background of light. The reason for this is that the film, though in colour a dirty creamy white, is opaque, and as the natural whites are represented by those parts of the film which have been most powerfully acted upon, and the natural blacks by those which have been more or less thinned by the developer, when both are held up to the light the opacity of the whites obscures the light and makes them seem black, while the light shining through the transparencies representing the natural blacks causes them to appear white But if the picture is placed upon a background of shade, the results will be exactly opposite, and the picture will appear as in nature, the white film representing the natural lights, and the dark background apparent through the transparencies representing the natural shades The application of these principles will be seen when the picture is completed, and only requires to be made to represent nature as it is, instead of the reverse, by treating it in the latter of the two ways above described and explained.

During the process of development the operator should strive to equalise the action of the developer, and not let the solution remain too long on one particular spot. He should also watch carefully to catch the precise moment when the picture is fully "out" in every minute detail, as from that moment the developer remaining on the film does more harm than good. When he thinks the development completed, the operator should allow the solution to drain away (if he is of a saving turn of mind) into a little basin placed in the sink, whence it can be afterwards transferred to some bottle or jar, in which it may finally be

put in the hands of any professional assayer The plate then should be thoroughly washed at the tap

It is now ready for the process of "fixing," which is to render it unassailable to the future action of light This is a very simple matter, but care should be taken to do it thoroughly, or those parts of the picture which have not been acted upon by the fixing solution will, on being afterwards exposed to light, turn perfectly black The Fixing Solution (*Cyanide of Potassium*, p 14) should be poured on while the plate is still wet, and allowed to thoroughly permeate the film. In a very few seconds, if the solution be of proper strength, a great change will take place in the colour of the film, the predominant tint losing much of its whiteness When all the parts of the image are uniformly and completely fixed, the cyanide solution can be allowed to drain back into the bottle, and the plate should again be thoroughly washed. This done, the operations requisite in taking a positive picture are virtually complete But to render it more suitable both for use and ornament a few further operations will be necessary, which are as follow —Allow the washed plate to dry either spontaneously or by the aid of moderate heat The latter is the most convenient course, as the plate, when dry, is naturally rather warm and in a fit condition to receive the coating of spirit varnish, which to some measure will protect the film and render it less liable to scratches The varnish can be poured on in precisely the same way as collodion, but the plate before varnishing should always be moderately warm After the surplus varnish is poured off, slight heat should again be applied for a few moments, when the plate is cool the varnish is dry, and the film can be touched without much of fear damage

It now only remains to provide the picture with a permanent background of shade This can be done in one or both of two ways. Either the plate can be allowed to rest on a piece of black velvet in a little frame, or the varnished side of the film can be c ted again with varnish, this time of a deep black colour If the former course be adopted, the plate should rest in the frame, film downwards If the latter be preferred, there is obviously only one choice. When the positive picture is fitted into a little frame, which can be bought of a pretty pattern at a very low price indeed, it forms an attractive little ornament fit for any mantelpiece or table

In Chapter V I shall suppose my readers to have become thoroughly conversant with and proficient in the art of taking positives, and shall try to render them equally so in the more useful and attractive negative process, by which any number of copies on paper can, by a further application of sun-printing, be multiplied.

CHAPTER V

The Negative Process—Collodion—Sensitising Bath—Developer—Intensifier—Sensitising—Light—Exposure Developing—Intensifying—Fixing

Before commencing the process of taking negatives, the learner should set aside his "positive" chemicals, and carefully procure and prepare those which it will now be necessary for him to employ The first of these will be collodion, the ordinary iodised collodion used for positives being replaced by that specially bromo-iodised for the negative process The particulars relating to these two, and the difference between them, I have already explained (Chap II, p 12) In the same chapter I gave formulæ for other preparations used exclusively in negative work Amongst these was a formula for the negative sensitising bath, as distinguished from that employed in producing positives The most important point of difference between them is, that while the latter ought to be freely acid, the former, by which denser pictures are to be obtained, should be but slightly so The stereotyped test of acidity is blue litmus paper, the colour of which, when it is immersed in a solution containing acid, changes to different hues of red, according to the strength of the acid in the solution. A positive sensitising bath should, therefore, turn a litmus paper immersed in it to a fairly bright red, while a litmus paper dipped in a negative bath should only change to a faint pink, a few rather more comprehensive hints as to the management, under incidental difficulties, of the sensitising bath will be found in Chapter VIII

After the negative developer has been made up according to the given formula, attention must be paid to the preparation of the intensifier, which is one of the exclusive requisites of the negative process Unless it is to be used very frequently indeed, the "pyro" solution should not be made up in large quantities, as it is subject to rapid discoloration and diminution of strength. The silver solution, with which it is afterwards mixed, is best administered in a "dropping" bottle, which can be bought at any chemist's or photographic chemical vendor's for a shilling or

eighteen-pence Many professionals and amateurs dispense with the separate bottle by merely adding to the pyro solution a few drops from the dipper of the sensitising bath, beginners, however, should eschew this in favour of the dropping bottle, which takes up very little space, and can be re-filled when necessary from a larger stock bottle containing an indefinite amount of the solution

And now for the manipulation which these negative chemicals will require After the glass plate (best polished sheet still being suitable, at any rate for a beginner) has been polished with great care, the collodion can be poured on in precisely the same manner as this operation was performed in the positive process. When the collodion is duly set, the plate must be plunged by means of the dipper, as before explained, into the negative sensitising bath and suffered to remain undisturbed for at least a minute, it can then be kept in vertical motion until the appearance of greasiness, arising from the repulsion of the water in the bath by the alcohol in the collodion, has completely disappeared After remaining in the bath for from one to two and a half minutes more, the plate can be removed and transferred, as in dealing with positives, to the dark slide

If the object of which it is desired to obtain a negative has, from want of a "glass room" or studio, to be operated upon in the open air, the photographer must make shift to control the light as best he can If a portrait is to be taken of a person sitting or standing against a wall, it will be necessary to place a screen a little above the sitter's head, this will serve to weaken the "top" light, which would otherwise, by its directness, cause the representation of the hair, &c, to be in disproportionate advance of the other parts of the picture, and therefore out of proper contrast. A useful implement in "lighting" is a large hoop covered with paper, like those employed in a circus, which can be held by a friend, to screen abrupt light from any part, especially the face, of the object Finally the operator should always, if possible, work with a northern light in preference to any other

The exposure required in the negative process, is about double that required under similar circumstances in positive work

When the exposure is completed and the shutter of the dark slide is closed down, the latter may, as before, be borne away to the dark room to be developed. After pouring a small quantity of the negative developer into its proper cup, the plate can be treated, as in the positive process, with the solution. If the plate has been properly exposed, the image will probably take from twenty to thirty seconds to appear in full detail, if under-exposed, the picture will take a long time to bring out, while over-exposure will cause the image to flash out all at once In the latter case, which is the lesser of the two evils arising from incorrect exposure,

the developer should be washed off at once, in other instances this can be done when the lights and shades of the picture are fully attained. The washing should be performed thoroughly, as the developer, in order that it may flow freely, contains a considerable portion of alcohol, which, as it is not contained in the intensifier, should be completely removed before intensification takes place.

It is advisable to have, besides the ordinary every-day developer, a slightly stronger sample (made by adding two or three additional grains of the proto-sulphate of iron to every ounce of the water prescribed by the given formula), to be used when the image is more than usually reluctant, or in cases where the lights have been extraordinarily bright and the contrasts with the shadows very great. When the developer becomes sluggish in cold weather, it can soon be brought to work well and rapidly by slightly heating it in a flask immediately before use.

When the developer has been well washed away, it will be more easy to see whether the image requires intensification. Experience alone can determine this, but, for a beginner, there can be no more useful help than a standard negative, which has been properly exposed, developed, and intensified, these are supplied by Frederick Cox, of 26, Ludgate-hill, at a shilling apiece—a moderate and really profitable investment.

If, as is usually the case, the negative requires intensification, the plate can be allowed to drain while the operator pours into a small measure about quarter of an ounce of the pyro solution. When this has been flowed over the film, it can be returned to the measure and receive the addition of a few drops of the solution of silver, and when this has, by the help of the dropping bottle, been accomplished, the mixed solution can be returned to the plate, and the intensification can be proceeded with until it is complete, if the intensifier become brown, it should be poured away and a fresh mixture substituted.

When the intensification is completed (this, again can be determined with moderate certainty, even by a beginner, by a second reference to the standard negative mentioned above), the intensifying solution can be washed off and the image fixed, if desired, in the open light.

If the operator has determined upon cyanide of potassium as his fixing agent, he can fix his negative as he would a positive, by merely pouring the solution over the film, letting it remain there until the yellowy-white iodide of silver of the shadows has been dissolved, and, finally, returning it to the bottle. I must not, however, leave this portion of the subject without again cautioning my readers against the reckless use of cyanide and other dangerous poisons, when substitutes can be procured, almost, if not quite, as effective, and having the merit of being harmless. If, however, in spite of warning, a beginner chooses to play with this particular

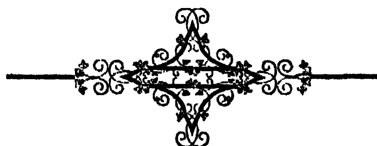
"edged tool," he must be especially careful not to let it come in contact with any acid, for, if this is allowed to happen, hydrocyanic acid vapour (prussic acid) is given off, a consequence which I hope few if any will fail to comprehend

When hyposulphite of soda is used, it can either be applied like the cyanide, or, what is better, poured into a shallow dish, into which the plate can be put until the fixing is completed

When the image is thoroughly fixed, whether by cyanide or hypo, the plate should be thoroughly well washed under the tap , if this is not done, the picture, from the undue corrosion of the fixing agent, will be utterly spoilt

The plate being dry and slightly heated, the varnish can be applied exactly as in the positive process, and when this is accomplished, the negative is really completed and ready for the further process of paper printing, which, as I have said, will shortly occupy a separate chapter

Having now explained all the operations leading up to the production of a negative image upon glass, I shall, in my next chapter, try to give my readers some idea as to how a good negative may be known, and how a poor one may occasionally be improved



CHAPTER VI.

How to Tell a Good Negative, and how (occasionally) to Improve a Poor One

As the production of good negatives is, or ought to be, the first and chiefest aim of the photographer, it is highly necessary for him to be able both readily and certainly to tell whether, after due care and attention on his part, his attempts have or have not been crowned with success In acquiring this knowledge he will find another use for the standard negative, the purchase of which I advocated in my last chapter The beginner should study this negative carefully, observing how every detail of the picture is represented, and, above all, strive to work up to its level in his own productions If he wishes to try his hand at all the three *genera* of portraiture—groups, full-lengths, and vignettes or head-and-shoulder pictures—he should procure specimen negatives of all three, so as to facilitate reference to their several points of recommendation

For the benefit of those who from inexperience cannot criticise the faults of a bad negative, or, what is more difficult, appreciate the merits of a good one, I will do my best to describe, with as little technicality as possible, a picture of a group (taken in the open air) which I have before me. It must not be thought that I am speaking of a perfect negative, as the production of such an one in the case of a group of human figures in the open air is, for many reasons, almost an impossibility The chief defect which, owing to care in lighting and manipulation, is rendered as little noticeable as possible, is a want of the delicate roundness in the delineation of the features, which is only to be met with in nature and in the highest class of studio pictures. But passing this over as inevitable, it is a good specimen of open-air portraiture, and will yield very creditable prints I may add, emphatically, that the apparatus, &c , with which it was produced corresponds minutely with the instructions given on that head in my commencing chapters

But to proceed with my description. The picture itself represents three ladies grouped on a rustic bench, which stands in a corner, formed by

the meeting at right angles of two garden walls Two of the ladies are sitting slightly apart on the seat itself, just behind, in the space between them, comes the figure of the third, who is seated upon one of the upright logs which form the back of the bench In the foreground, which is very slight, is a plant about 2ft high The walls, serving as a background, are covered with the leaves of a trailing vine, which have a singularly graceful effect Now, by laying the negative upon some dark body, say a piece of black cloth, which will serve as a background of shade, the picture seems to be a correctly outlined but unreasonably dense positive, on holding it, however, up to the light, and looking *through* and not *at* it (that is by transmitted instead of reflected light), the image appears brilliant and full of the minutest detail, both in its lights and shades, which are now, of course (see Chap IV) reversed. The lights and shades, too, are in perfect gradation of "tone," and exhibit abundance of a sort of mean of gradation between the "high" lights and deep shades, which is technically termed *half-tone*, and is a prominent qualification in a well-printing negative This correctness in the gradation of tone is a consummation devoutly to be wished by the beginner, who usually fails to attain it by faulty exposure, or from some other cause denoting want of experience rather than want of care

Another striking point in the picture is its exquisite clearness of definition throughout As there is little or no distance, the veinings of the vine leaves on the wall are almost as distinct as the straw plaiting of the garden hat which one of the sitters on the bench holds in her hand, or the flowers of the plant in the immediate foreground Of course such clear definition would not have been attainable without the help of a rather small diaphragm, but the light being good, and the operations taking place in free atmosphere, the exposure was by no means uncomfortably long

A third characteristic of the negative is the evenness of its lighting and its perfect freedom from the abrupt patches of light which so often ruin the otherwise pleasing effect of an open-air portrait or group These patches are caused, as I have explained before, by the falling of a direct ray of light upon some undefended portion of the object or objects. Their effect is apt to be underrated by beginners, who can often hardly discern their presence on the dull coloured film of the negative, but when the time comes for "pulling" a print, they will speedily be undeceived For instance, I am the possessor of a negative, which to an unpractised eye seems faultlessly lighted, but in the print from it one of the sitters has a bar of shade running straight across his nose, while the rest of the picture is lighted up in the most fantastic manner.

Abrupt patches of light can easily be obviated either by using the

paper covered hoop, or by working when the sun is invisible and the light equably diffused These courses are to be adopted with advantage to the character of the shades as well as to that of the lights of the picture Thus in the negative before me there is *no absolute transparency*, which in printing would give a hard unyielding black

Above all my negative is practically as well as theoretically good, and produces in the printing frame natural and harmonious little pictures

Of course there can exist no surer criterion of the quality of a negative than the quality of a print from it, but by experience and a system of careful and minute observation, such as I have endeavoured to describe, the photographer may be able not only to weigh accurately the quality of his finished negative, but even, from the moment the intensifier has left the plate, to foretell the character of a resultant print

And now that some idea has, let me hope, been formed as to how the merits of a good negative may be duly recognised, I will proceed to the more uncongenial task of striving to remedy in some measure the defects of a bad one In nine cases out of ten this would involve a hopeless waste of time, and it is far better to wipe off the defaulter, sensitise afresh, and secure a second and perhaps satisfactory picture But it now and then happens that on looking out negatives for printing, you meet with one of some favourite object, of which you possess but this one souvenir, and are unable to procure another And it not unfrequently occurs that this particular negative, from some oversight or carelessness in manipulation, is a worthless one, and unfit for printing purposes Hence it is desirable to have it in one's power occasionally to utilise a failing negative, by removing or lessoning those defects in it which prevent it from producing decent prints

To begin with, before any steps are taken, the negative should be strictly and closely examined This course will probably lead to the adoption of one of the three following conclusions (1) that the mistakes to which the faultiness of the negative is due are utterly irremediable, (2) that the negative presents an air of general incapability, but that there is no absolute reason why it should not ultimately be brought to the "sticking point," (3) that there are certain slight defects in the picture which, if removed, would leave the negative in perfect printing order, or something so nearly like it that the success of an attempt would justify the trouble spent in making it.

In the first of these three cases, when the negative is ruined by some irremediable defect, such as faulty focus or a bad attack of "fog," a farewell must be taken of the object, and no time lost in setting about other and more satisfactory work

With regard to No. 2, there is a decided gleam of hope. The "general

air of incapability" more often than not results from insufficient intensification, a mistake to which beginners are particularly liable An obvious remedy for this is to intensify over again, but this is to be accomplished in a peculiar way, and not with the ordinary " acid pyro" and silver Suppose the negative to have been varnished in the ordinary manner, proceed as follows Flow over the film a little alcohol or strong spirits of wine, which will have the effect of softening the set and hardened varnish Then add a few drops of tincture of iodine to 1oz of fresh varnish in a measure When the colour begins to resemble that of light port wine, flood the film with the iodised varnish In a very short time the film will absorb the non actinic colour of the varnish, and the reintensification is accomplished When this is done wash off what remains of the iodised varnish with a little alcohol, rinse under the tap, allow the film to dry, and revarnish it in the ordinary manner The mistake usually arising in this operation is a scepticism as to the extent of the change which has been effected This will soon be removed when a comparison is made between the prints from the negative before and after reintensification

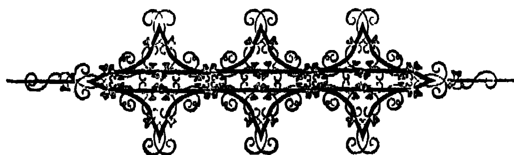
Conclusion No 3 includes rather a wide range of contingencies The chief of these are pronounced transparencies on the film, which yield unreasonably deep shades in the print These defects can often be almost completely removed by an operation called retouching This is performed by means of a black-lead pencil, a paint brush and water colour or black lead powder and a paper stump The successful practice of retouching rises to the dignity of an art, and as such takes a high place in photographic commerce Many professional photographers send their really good negatives to be retouched by professional retouchers, a course which the amateur is welcome to adopt or not, when he has negatives worthy of this honour, for the present, if he has any skill at all with the pencil or brush, he should be content to have the power of obtaining creditable prints from poor negatives, which he would otherwise be compelled to cast aside

Let me suppose, then, that a print has been "pulled" from the negative which shows shadows too heavy for the other parts of the picture What is obviously required is to block up to a certain degree the transparencies in the negative to which these dense "blacks" in the print are due Laying aside the powdered black lead, and even the water colour, unless the transparencies to be blocked out are of considerable size, sharpen a good B pencil to a fine point and try its effect upon the surface of the film If, as is usually the case, the pencil refuses to "bite" on the smooth varnish, a little very finely powdered resin should be taken on the point of the forefinger, and gently rubbed, with a circular motion,

over the parts to be retouched The negative can then be placed on a retouching desk or frame, such as may be bought, of ordinary quality, at any of the shops, for about 15s Failing a desk, a beginner can effect great improvements in his negatives, even by working against a window pane

Besides, by retouching and reintensification, a faulty negative can often, by skilful printing, be made to yield decent pictures A few hints as to various little ' dodges" in printing will be found in another chapter

The addition, by artificial means, of *clouds* to *landscapes*, will be discussed in a chapter entirely devoted to that branch of photography



CHAPTER VII

Defects and Failures—Reasons and Remedies—Spots—Comets—Slipping Films—Lines—Crape, Pinhole, and Fog—Stains—Defects in Film Dissolved by Varnish.

Although up to the present moment the continuity of my descriptions relating to manipulations, &c, either in positive or negative work, has been little, if at all, interrupted by any mention of defects or failures, I trust I shall be far from discouraging any of my readers when I ask them to pay especial attention to the present chapter, on the ground that it will probably be the one to which they will have, hereafter, most frequently to refer It is hardly to be expected that an art, capable of such exceedingly delicate results as photography, can be successfully practised without some slight drawbacks, or even an occasional failure If the beginner is really disheartened by such *contretemps* he simply does not deserve to succeed Moreover, in photography, failure is so comparatively rare, and so often owing to wanton neglect of simple and easily-followed instruction, that, in nine cases out of ten, the operator has himself alone to blame for any defect in his finished picture or mishap in preceding operations There are, however, certain little troubles to be met with in photography, as in everything else, which are only to be overcome by experience or by turning to account a timely word of warning, it is to such that the present and two succeeding chapters will be devoted There is a well-known saying of a Latin poet, which I will freely translate "Happy is he who has acquired the power of knowing the reasons of things." This maxim I wish to be the key-note of any remarks applying on which it may be found necessary to make defects or failures. It is not enough to know that a picture is defective, nor even to be able to describe its failings in the most accurate and technical style, the knowledge which every photographer should seek, above all other, to acquire is that of probing, like a skilful physician, straight to the root of a difficulty, hence, to discover the nature of the source from which it springs, and, by removing or modifying this source,

to prevent the recurrence of the failure, defect, or mishap After this necessary preface I will proceed to review the annoyances themselves.

The first and perhaps most frequently met with defect, both in the positive and negatives of beginners, is the presence upon the film of a host of minute spots, either transparent or opaque, or both A common cause of these is dust in the dark room, dark slide, or camera The tiny particles settle with peculiar tenacity upon the moist film, and usually remain invisible until development, when they are either washed off, taking with them a corresponding particle of the film and leaving a transparency in its place, or remain, forming an opaque spot which (in the case of negatives) will produce a white spot on the paper-print With regard to removing the source of this vexation, I can only reiterate my advice concerning dust, expressed in former chapters Possessors of dust-spotted negatives, doubtful as to their capabilities for producing respectable prints, will find that a transparent spot on any part of the negative representing deep shade can be left alone with impunity, while, if one occur in a sky or other "high" light, it can be readily removed by a stroke of the retouching pencil or brush Opaque spots can be dealt with *vice versâ* If a transparent spot occurs in a half tone, the beginner will perhaps find it best to block it (the transparency) completely out, and to work it into the paper print with Indian ink

Another fertile source of spotty films is collodion Spots and streaks caused by collodion are brought about in one of two ways either by the fall on to the film from the mouth of the pouring bottle, of particles of collodion from which the ether has evaporated, or by the sediment or "bottoms" being shaken into suspension, and flowing along with the collodion when the latter is poured over the plate Imperfections arising from the first of these two causes are designated by the expressive name of "comets," and can, as I have before explained, be obviated by the use of a "cometless" bottle The remedy usually prescribed for spots caused by particles floating in the collodion itself is filtration through one of the ingenious collodion-filters now sold at all the principal shops, but I perceive in the *Photographic News Almanac* for 1878 such a reasonable protest by M. Piquepe against this practice that the least I can do is to give my readers the benefit of his valuable opinion His argument is decidedly against filtering as a means of removing impurities in suspension, and as decidedly in favour of decantation. He observes most justly that filtration cannot fail, in some way or another, to destroy the proportion in which delicate preparations such as collodion are made up, moreover, as M. Piquepe continues, "it frequently happens that the cotton-wool which is generally used for filtering (even when previously washed with alcohol) will let slip in the collodion a great many particles, which,

perhaps, imperceptible to our eyes, will not fail to make their apparition under the influence of the developer, and to each particle will correspond on the negative a deep transparent pinhole, or long thin line, which produces a deplorable effect" But by decantation, i e, by allowing the liquid to settle and all impurities to sink to the bottom, and then carefully decanting it into some other vessel, the collodion is kept in its original proportions and in a state of brilliant clearness The process is, moreover, as simple as it is efficient Those who are unwilling to be convinced by the summarised argument to which I must necessarily limit myself, will find M Piquepe's able little paper on pp 112-114 of the *Almanac* His remarks on the destruction of original proportions apply also to the remedy often suggested for thinning collodion, which, by evaporation of the ether, has become thick, and flows with difficulty, by adding more ether to replace that which has been lost Although an experienced operator may occasionally avail himself of this convenient remedy, a beginner should attempt nothing of the sort. It is to these slipshod atonements for mistakes, due solely to utter carelessness, that a great portion of the eccentricities so often attributed to the really excellent collodions and other photographic preparations of commerce, is really due If he keeps his collodion bottles (large and small) thoroughly well stoppered, the operator will find that he loses very little collodion by evaporation, and if an ounce or so at the bottom of a bottle does get a little thick, it is a far better plan to use it up in some other way, such as cleaning glass, plates, &c, than to attempt promiscuous doctoring with ether /

Besides "comets," streaks, and spots, there is another little trouble which the beginner will probably encounter in connection with the collodion It sometimes occurs that when subjecting a positive or negative to a stream of water, after development, the film suddenly peels off the plate, and disappears down the sink To remedy this annoyance he must go back to the pouring of the collodion on to the plate The most frequent cause of "slipping films" is undue haste in sensitising the collodionised plate The collodion should be allowed to set thoroughly, and until it does so should not be allowed to enter the sensitising bath If allowed to dry the film will be of a horny character, and its sensitiveness materially impaired The exact time between collodionising and sensitising is a matter which a very little experience will decide

Lines on the film can generally be traced either to a stoppage in the motion of the hand which let the plate down into the sensitising bath, or by the imperfect flow of the developer over the plate The cautious addition of a little alcohol will usually remedy this last defect "Crape" has been already mentioned, see Chapter IV, p. 22.

The sensitising bath is such an universal scapegoat for all kinds of defects and failures, from "pinhole" to "fog," that, to save repetition, "the sensitising bath under difficulties" will be treated at considerable length in a separate chapter

Stains on the film are to be traced almost always to the dark slide. They are defects which ought never to be allowed to appear, and are the direct product of carelessness They are caused by the refuse silver solution flowing downwards from the wet plate and contaminating the silver wire corners of the plate carriers The remedy for this nuisance is the employment of small pads of blotting paper to catch the refuse drops After the removal of every plate the wet pads should be thrown away and replaced by dry ones The operator should make a point also of continually wiping out both dark slide and camera with a wet cloth to prevent accumulation of dust

The chief defects in intensification are such as I have described, with some hints as to their removal, in Chapter VI In fixing, if the iodide is not sufficiently dissolved out by the fixing agent, a dense yellowy bluish veil is left on the portions undissolved, which produces, from the absence of any gradation of tone, a corresponding want of contrast in the paper proof. The cure for this defect is obvious

In varnishing, the most unpleasant contingency (fortunately of not very frequent occurrence) is the evanescence, by dissolution, of the film the moment the varnish is flowed over the plate This is owing to the spirit solvent in the varnish being stronger than the spirit solvent in the collodion , sometimes the addition of a little water to the former removes this annoyance

Besides the above defects and failures, there are, it is true, several others of more or less importance , these, however, are so obviously due to neglect in following given instructions, that any mention of them would necessitate a complete recapitulation of the preliminary chapters of this series If the beginner follows the instructions given him with proper care and attention he will be amply rewarded by having to contend against none of the difficulties which neglect of them entails , while he who wantonly passes over important points of instruction, because they happen to be "a wee bit dry," fully deserves the pleasure of having to turn back and master them



CHAPTER VIII

The Sensitising Bath under Difficulties—Fog, its Causes and Cure.

As the sensitising bath is the most important element of the wet collodion process, it is only natural that from it more numerous and more perplexing difficulties should arise than from any of its fellow operations It is for this reason that I have postponed any mention of such difficulties until the list of defects and failures, for which other stages of the process are responsible, was complete In this chapter, too, I shall make mention of "fog," as, although it is occasionally due to other causes, its appearance is so often connected with the state of the sensitising bath that any account of one apart from the other would involve much unnecessary prolixity and repetition

It must not be thought that it is a law of photographic nature that the sensitising bath should be in a constant state of ill behaviour—quite the contrary A bath, fairly used and fairly cared for, will often produce as good negatives at the end of three or four months as it did on the first day that it was tried On the other hand, in spite of all possible precautions, it may begin to show the cloven-foot in a few weeks or even days. What is to be done with it under such trying circumstances as these is always a source of much vexation of spirit to the beginner. The usual advice given to all amateurs is that the moment the sensitising bath gets out of order it should be promptly discarded and take its place among the residues in the waste tub. This is a highly convenient system, and those may adopt it who choose, especially in the case of a well worn and aged bath that has done good work for two or three months, and is beginning to show signs of serious indisposition, but, unfortunately, the beginner is frequently under the delusion that his bath is at fault, when it is nothing of the kind. In a case like this to throw away a carefully prepared bath, which has, perhaps, only been in use for a few days, for the mere reason that the owner imagines something is wrong with it, and is unwilling to take the trouble of going to the

real root of his misfortune, is more often than not sheer lazy folly To lessen the possibility of my readers falling into habits like this I will now endeavour to give some idea as to the *bonâ fide* difficulties arising from the use of the sensitising bath, how they may be traced, and how sometimes avoided, a course, to say the least, more satisfactory than that of merely treating the (presumably) faulty bath as practically useless rubbish, for which a certain price will be given by the assayer, whose industry is only too often employed in repairing the effects of his customer's indolence

The causes of the defects for which the sensitising bath is responsible may be conveniently distributed under two heads The *mechanical*, or those which arise from carelessness in manipulation, miscarriage of apparatus, &c , and the *chemical*, or those due to the imperfect or too vigorous action of the chemical compounds with which the use of the bath is connected Of the former kind of defects the chief are the tiny opaque or transparent spots, of whose appearance in connection with other stages of the wet collodion process, I warned my readers in my last chapter. As they are due to precisely the same cause, I trust the repetition of my warning will be all but needless But, simple as the remedy may seem to prevent dust and other impurities from entering the bath, they frequently make their way into it, in spite of all fancied precautions, and promptly manifest their presence by attaching themselves to the collodion film while the latter is being sensitised As in the case of dust-spots contracted both before and after sensitising, the particles either remain imbedded or are dissolved out, thus producing, as the case may be, transparencies or opacities The dust can be to a great measure driven away from the bath solution by keeping the bath in a case with a hinged cover, such as I recommended in Chap III This cover should be kept rigorously closed down, except when the plate is being plunged into or drawn out from the bath It should not be shut down with a bang, as the slightest jar will often displace an incredible amount of dust. If, after all, the solution does become full of "mechanical" impurities, the directest remedy is to pour the solution into a measure, filter, or, what is better (see Chap VII), allow to settle, and carefully decant back into the bath, which should have been previously washed out with distilled water to remove impurities adhering to its sides. If filtration or decantation be inconvenient, a pretty certain method of obviating dust-spots arising from the sensitising bath is to have, in addition to the hinged support on which the case mainly rests, another similar support on the other side of the case, so that the bath can either lean towards or away from the operator Of course the former will be its position whilst the plate is being plunged into it, but when the

plate reaches the bottom the case can be safely turned over so as to lean the other way, until the plate requires agitation or removal. By this means the chance of particles of dust settling on the film during sensitising is materially reduced, but though a safe, it is a somewhat inconvenient remedy.

A source of impurity in the bath, often overlooked by beginners, is want of care in cleaning the glass plates, the evils arising from which are a continued source of trouble to the slovenly operator.

And now for a specimen of the class of "chemical" defects Transparent spots on the film are not alone due to dust or "mechanical" impurities An even commoner cause is excess of iodide in the bath solution The transparent spots thus produced are known as "pinholes," and can generally be distinguished from those due to dust by their minuteness and total occupation of the whole surface of the film

The usual cure recommended for pinhole is to dilute the bath solution with its own bulk of water, filter, and add fresh crystals of nitrate of silver to make the new solution up to its proper strength Thus, if a 35 grain bath of 8oz shows signs of pinhole, another 8oz of distilled water should be added, the whole 16oz filtered, and 280 grains of nitrate of silver dropped into it Another cure now very frequently adopted for the removal of pinholes, and one which does not necessitate doubling the quantity of the bath solution, is to add to the latter about 2 grains to the ounce of *nitrate of baryta*, agitating and filtering This often proves a certain and lasting remedy, but frequently misleads beginners from the appearance on the plate, during development, of a bluish veil, which does not disappear after fixing This is due to the sulphate of iron in the developer precipitating the baryta as an insoluble sulphate, the bluish colour, however, almost entirely departs on the application of the varnish

When the bath has become contaminated by some foreign chemical substance, as, for instance, ether, which enters through the medium of the collodion, an almost unfailing remedy is to *sun* the solution This is done in the following manner The bath is poured into a clean glass measure, and carbonate of soda is added until a litmus-paper immersed in it no longer turns pink, this is called neutralisation The bath is then left in the sun for a day or two. When the sunning is completed, it will be found that all the impurities have sunk to the bottom of the measure in the form of a black sediment. The solution can now be either filtered or carefully decanted, it must finally be acidulated by cautiously adding glacial acetic acid until the faint pink tinge in the litmus-paper is once more given.

Many photographers are in the habit of constantly sunning their bath

solutions, even though no trace of pinhole has appeared in the negatives produced by them, this, doubtless, reduces the chance of pinhole to a minimum.

Besides ether, the collodion film introduces alcohol into the bath A solution which has been used for a very long time will necessarily become strongly impregnated with alcohol, a common cause of lines on the film To get rid of the alcohol, the solution must be boiled, so as to allow the spirit to evaporate This can be done by setting a large evaporating dish containing the solution to be boiled on a stand, and introducing below it a Bunsen gas-flame When, however, matters come to the boiling point, I advise my readers to desist Sunning and doctoring baths are all very well, but boiling is another thing A bath does not want boiling until a great many negatives have been produced from it, as the quantity of alcohol which remains to contaminate the bath after the immersion of a collodion film is, if the collodion has been given fair time to set before immersion, exceedingly small Hence it is quite worth while for the amateur to turn out his alcoholic old veteran into the waste-tub, and let the assayer have the trouble of rejuvenating him

There is yet another difficulty connected with the sensitising bath, which, although it is not of very frequent occurrence, should be included in a list of "defects and failures" It is a repetition of those transparent spots on the film, two reasons for the appearance of which (dust and excess of iodide) I have already given But the manner of their appearance is different instead of showing themselves on the application of the developer, they reserve their energies until after the image has been fixed The reason for this is exactly the reverse of that to which "chemical" pinhole is due—instead of excess, there is insufficiency of iodide in the sensitising bath This is brought about as follows whether by the number of plates which have been sensitised in it, or to accidental waste by spilling, &c, the bath solution becoming thus, in the course of time, decreased in quantity To bring it up to its necessary volume a solution of nitrate of silver, about thirty-five or forty grains (according to the original strength of the bath) to the ounce of distilled water, may be added. If the decrease is owing to the natural absorption of the solution by a great number of films, there is seldom need for any further addition to the simple silver solution employed to replace it, as the iodide imparted during the immersion of the plates, coated as they were with iodised collodion, will probably have been sufficient to keep the bath in order. If, on the contrary, the bath is comparatively new and the diminution in its quantity is owing to some portion having been spilt, or otherwise used up in circumstances where the necessary loss of iodide is not compensated for in the replenished solution, the case will be different,

and the results will be the post-fixation pinhole previously mentioned. Insufficiency of iodide arises also frequently from extensive sunning and filtration The obvious remedy is to add as many grains of iodide of potassium as may be found necessary to bring the iodide of silver up to its proper strength, or, if there is not any iodide of potassium handy to add to the under iodised bath, another course, quite as simple and effectual may be adopted—a glass plate with ordinary bromo-iodised collodion, and leave it immersed in the bath for about an hour. On the removal of the plate it will be found that the iodide of the collodion has been completely eaten up by and absorbed into the former

Some photographers iodise their baths in the first instance by leaving a collodionised plate immersed in an acidulated silver solution for a lengthened period, but, as the long immersion involves the liberation (in infinitesimal quantities, it is true) of alcohol and ether as well as of iodide, it is as well, when iodide of potassium is handy, to use it The other course, however, has always the merit of being convenient, and the knowledge of its efficacy will often be found a useful "wrinkle"

And now for my long promised account of "fog" This terrible apparition may be simply described as a dense veil-like formation on the film, which appears during development, and which, by producing from its non-actinic colour irregular patches of white in the print, more often than not renders the negative useless Its causes may be distributed under four heads—over exposure, admission of promiscuous white light into the dark slide, camera, or dark room, alkalinity of the sensitising bath, and deficiency of acetic acid in the developer In order to give a clearer idea of the manner in which fog may arise from any of the above sources, I will once more adopt the plan I have already found so convenient—I mean of placing myself in the same predicament as that from which it is my object to teach my readers to extricate themselves, and of detailing my mode of procedure under the influence of an imaginary attack of fog

Before commencing, however, I wish to remind all that the steady and methodical patience essential in tracing with success the causes of fog is only a type of the temper in which other little photographic mishaps should be encountered It is far better, if a hitch occurs, to come voluntarily to a dead stop, and to render oneself familiar with its *raison d'être*, and the course to adopt in the event of its recurrence, than to lose "nine stitches" hereafter from lazy neglect of the "one in time"

But to proceed Let me suppose that, on pouring on the developer my plate discovers unmistakable signs of fog. To begin with, instead getting out of humour, I calmly, after a few more sweeps of the developer to see if more fog is in store, wash and fix the film I then inspect it

carefully, in order to determine, if possible, my basis of operations I shall find that the film is either partially or wholly covered by the foggy veil In the former case, especially when the patch is sharp and angular, the fog is usually due to the "admission of a promiscuous ray of white light" Under an impression like this, I should immediately take a cursory view of my dark room, striving to discover an accidental chink in the woodwork or a tear in the orange paper with which the window is rendered non-actinic, the dark slide would next be subjected to the same scrutiny, and finally the camera itself If any defect capable of producing fog were met with, I should promptly rectify it and try another plate If, however, my general search were unrewarded with success I should test the room, slide, and camera separately, in a way I shall presently describe Failing these, I should proceed as if in the first instance I had taken no notice of the film being partially or wholly fogged

If the fog flashes out at once all over the plate, I know there is some serious fault in the apparatus, the chemicals, or the manipulation My first step is to sensitise a fresh plate and expose it for a considerably less time than I did the first and faulty one If after this the plate developes cleanly, it is evident that the fog was due to over-exposure, this is often the case with beginners, whose only idea is "to make sure" of a speedy development

Having satisfied myself, however, that over-exposure is not the error into which I have fallen, I have recourse to another experiment I develop the next plate with a portion of developer into which has been dropped about a minim of *glacial acetic acid* If the weather is hot, or if the developer has been carelessly mixed, it is very possible that the insufficiency of acetic acid is the real cause of my trouble

After, or even before (to save the trouble, perhaps, of having to prepare an extra plate) the condition of the developer has been called to account, a simple and important test should be put to the sensitising bath Thinking, with good reason, perhaps, that I have got at last to the root of the evil, I pour a little of the bath solution into a small measure I immerse a blue litmus paper in the solution for a few seconds, if the colour changes to a faint pink, I know that the bath is duly acidulated, and that I must turn my researches in another direction If, on the contrary, the litmus paper does not change its colour, I see that the fog on my negatives is due to the alkalinity of the bath. Pouring the whole of the bath into a large measure, I cautiously add drops of glacial acetic acid until the blue litmus paper changes on immersion to its proper pinkish hue

In the event of the litmus paper showing on its first immersion that the

bath is in good order, it is necessary to retrace one's steps a little I have proved conclusively that there is nothing in the exposure, nothing in the developer, and, finally, nothing in the bath conducive to fog The one point on which I have not thoroughly satisfied myself is the question of 'promiscuous light" I therefore prepare a plate with the view of testing the non-actinic qualities of my dark room When removed from the sensitising bath, I simply lay the plate down on the table and leave it for a few minutes untouched I then treat it with the developing solution as I would an exposed film If the fog appears, my dark room has pleaded "guilty" quite as plainly as in words, and I do not rest until the defect is discovered and set right

When the dark room is at fault the blame can generally be laid to the window Operators should take especial care to render this incapable of fogging even the most sensitive plate, but at the same time there is no need to resort helplessly to the plan of blocking up the window altogether, and working by the dingy light of a candle It is far easier and (photographically speaking) more workmanlike to paste over the panes two or three thicknesses of orange paper than to spend boards, nails, and time in shutting out altogether the light of day

To test the dark slide, a sensitised plate should be inserted exactly as if for exposure in the camera Instead, however, of taking its place in the camera, it should be placed by itself in the open light for perhaps a minute Development will quickly decide whether its construction or condition is at fault

The camera I should prove by inserting the dark slide and pulling up its shutter without removing the cap from the lens The proof will lie, as before, in the result of the development

If none of the above "researches" succeed in unearthing the causes of fog (a contingency highly improbable), the sensitising bath should be sunned as directed at the commencement of this chapter This will serve to eliminate all particles of foreign matter which occasionally have a foggy tendency.

It will be understood that, although I have given the above system for tracing the causes of fog as the one practised by myself, I do not mean to say that I personally never depart from it For instance, to waste a plate on testing for over-exposure is the last resource on which I, as one whom experience has taught to regulate exposure by fixed and seldom erring rules, would care to fall back It is in instances like these that a practised hand may bend a system to suit himself, and I hope this fact will lend additional weight to the caution I give to beginners—on no account to take any liberties whatever with prescribed systems or methods, of the very elements of which they are all but ignorant

CHAPTER IX

WET COLLODION IN THE FIELD.

BEFORE commencing any detailed description of the apparatus necessary for taking landscape negatives, it will be as well to sketch briefly the nature of the distinction which it is necessary in this point to draw between photography at home and photography abroad The first uestion which arises is an obvious one It is quite possible to convey to any given place the camera with its fittings and tripod But suppose the spot which it is required to photograph is some miles away from home, and even one negative, not to mention five or six different ones, are wanted, how is the dark room to be dispensed with? Now, this problem can be solved in two distinct ways The first method is to prepare in a peculiar manner the plates at home previously to starting on an expedition, and to take them out, expose them, and bring them back in a dry state This is called dry-plate photography, and from the facility it affords to tourists and others to whom the smallest burden is of consequence, is daily growing into favour with many photographers, both amateur and professional But in spite of the improvements which, from time to time are being made in "dry" processes, they are always subject to one great drawback—the operator is never certain of success, for it is impossible to tell whether a good picture has been secured until home is reached and development performed This difficulty is completely overcome by a second method of landscape photography, to which the present chapter will have especial reference In it wet collodion is still the *primum mobile*, and the dark room is represented by a portable box or tent, or combination of the two, which the operator carries with him, and in which he prepares and subsequently developes as many plates as he may chance to require. That such a portable dark room is a possibility I shall show hereafter, when I come to give a separate description of a dark tent with its complement of bottles, tank, sink, &c But if the operator is to carry his dark room bodily for a distance perhaps of five or six miles, it is absolutely necessary for the rest of his apparatus to be eminently portable likewise. As some guidance is necessary in choosing

a portable and at the same time efficient outfit for the practice of wet collodion in the field, I will now proceed to give a few instructions, by following which an intending landscape artist will profit not only in the point of comfort but in successful results

The first point which (putting aside the question of the dark tent) demands attention is the size which the operator wishes to make his standard in taking landscapes, and the consequent size of the camera in which his pictures are to be produced Now, if my readers will take my advice on this point, they will go to some well-known dealer, and procure of him what is known as a Stereoscopic folding camera There is no necessity at all to use these instruments exclusively for stereoscopic pictures They are almost invariably sold with an extra front, which enables the operator to take landscapes on the full size of the plate, usually about 7½in by 5in They should be fitted with a "double swing-back" and a "winch screw," which is highly convenient for focussing They have always a central movable partition, which is used in taking stereoscopic pictures, or two carte-de-visite portraits on one plate A camera such as one of these costs from £4 to £5, and is always a thoroughly reliable and generally useful piece of apparatus

We must now turn to the lens, which is a most important point The ordinary landscape lens is a single combination, formed of two or three lenses joined together with transparent cement But this single combination is subject to a fault, which at times is most inconvenient, namely, that of distortion This is not noticeable in taking ordinary landscapes, but it is most annoying when photographing a house, or any other such object, to find all the marginal lines completely "out of the straight" There are certain classes of lens, doublet and triplet, which correct this distortion Of these the most noted are Dallmeyer's "Rapid Rectilinears," one of which every landscape photographer should, if he can afford it, procure Their rapidity makes these lenses especially useful in cases where animate objects form part of the picture They can even be employed with success in taking portraits Ross's Portable and Rapid "Symmetricals" are also fine and justly celebrated anti-distortion lenses In confined situations, where the angle of the ordinary single or doublet lens (usually from 60 to 70 degrees) is not wide enough to take in the whole of the picture, a "wide-angle" lens is necessary These can be bought if wished to cover the whole plate without stops, but a simpler and cheaper plan is to buy a lens covering the size below the one in ordinary use, and to increase its angle as well as its definition by the use of stops Thus, a 5in. by 4in rectilinear or symmetrical can, by the use of a small stop, be made to take very wide-angle pictures up to 7in by 5in If the operator can only afford to buy one good lens, he should by all means

get a doublet of some maker of undoubted reputation I may remind my readers that there are several most respectable shops at which genuine lenses of such makers as Dallmeyer, Ross, Grubb, Stenheil, and others may be procured secondhand at a great reduction, considering the little or no deterioration to which lenses, however rough, may have been their usage, are subject. Although it is very pleasant to have one's lenses direct from the manufactory, still, for those to whom expenditure is a serious consideration, it is a far better plan to have a lens with a good maker's name on its tube, however tarnished and dented the latter may be, so long as the former is clear and brilliant, than to have a wretched piece of bad flint set in fittings of resplendent brass, which was bought because it was as cheap as it was new

From the camera and lens to the tripod is but a step There are many kinds of portable tripods on all sorts of principles One that can be thoroughly recommended is that for which Mr Kennett, of Maddox street, has obtained a patent Its chief peculiarity lies in sliding ferrules, by which the legs of the stand are adjusted These legs are removable from the slab on which the camera rests, and can be easily carried under an arm or in a disengaged hand

A good kind of glass plate to use for small landscapes is flatted crown Many photographers also employ Forrest's patent plate substitute, which is a glass of good quality, and is sold at a moderate price The glass plates should always be thoroughly cleaned before starting on a photographic expedition This done, they can, until they are wanted, be kept in any common white wood box, grooved to prevent scratching Only as many glasses should be taken out as will be required for the day, as glass is very heavy, and plate boxes with a great number of grooves very clumsy If the operator prefers before leaving any spot to varnish the negative he has just taken of it, these finished negatives can be brought home along with what remains of the clean plates If, however, he desires to store them away the moment they are washed after fixation, with a view to varnishing them at some future period, he should procure a metal box specially adapted for the purpose of receiving wet negatives. These are sold by the dealers for about six or seven shillings apiece

When the operator has procured the above indispensable apparatus for the comfortable and successful practice of outdoor photography of any kind, he can turn his attention to the construction and furniture of the dark tent, which I shall now proceed to describe



CHAPTER X

Dark Tents and their Construction.

Of all the so-called "dark tents" the simplest in construction and design is that which is known, from the inventor's name, as the "Howard" This "unique and portable little dark room," as the advertisement very fairly calls it, is made of indiarubber lined cloth, and is so constructed as to have for its supports the upper part of the legs of an ordinary camera-tripod It is fitted with eye-holes and armholes, and also with a "window" of non-actinic cloth, capable of admitting quite as much light as is needed To sensitise and develop, the operator sits down on the box in which he carries his chemicals, &c The whole concern is a convenient and easily adjustable little apparatus, and for working small wet collodion plates in the field nothing handier can be desired The tent will also be found useful in changing dry plates when double dark slides or a changing box are not accessible Its price, exclusive of the stand, which is not required, any good camera tripod being suitable, is £1 It can be procured of most photographic dealers, but the sole manufacturers are Lee Brothers, 27, Watling-street, E C The accompanying woodcut shows at a glance the nature and principle of the Howard tent

But it will be seen that, ingenious and efficient as the above explained apparatus indisputably is for pictures up to, say, 5in by 4in, when plates of larger sizes, such as whole plate or even 7½in by 5in, are o be manipulated, something more substantial will be required The form usually employed in such cases is the "Box" tent, of which there are many varieties, both commercial and otherwise Of the former, the best known are the "model" tents of W W. Rouch, 180, Strand, which are very perfect and convenient. A tent for working plates up 8½in. by 6½in, complete with fittings, costs between £6 and £7, and the outlay once afforded will never be regretted by the true photographer To those who are either not in a position to purchase a tent ready made and fitted, or who prefer to make their apparatus to suit their individual convenience, I will give a few hints on the construction of a fairly portable box tent,

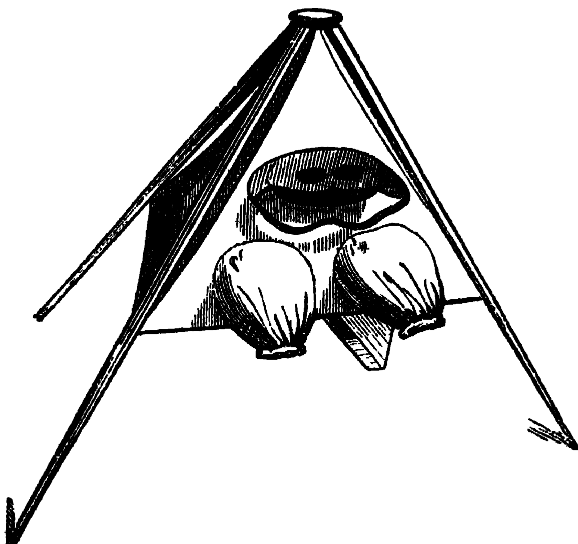


FIG. 4. THE HOWARD DARK TENT

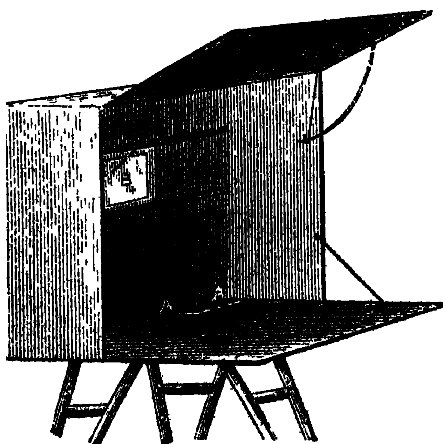


FIG. 5. THE BOX DARK TENT

which, though of course unequal in completeness and finish to the many varieties in the photographic market, will still be found workable and, comparatively speaking, inexpensive Annexed are two illustrations on which my hints will be based.

Fig 5 represents the box tent without fittings It is a plain box (preferably of deal, for the sake of lightness), with two doors like those of a cupboard turned on its side The upper door opens on a slant rather higher than the top side of the box itself, and forms a

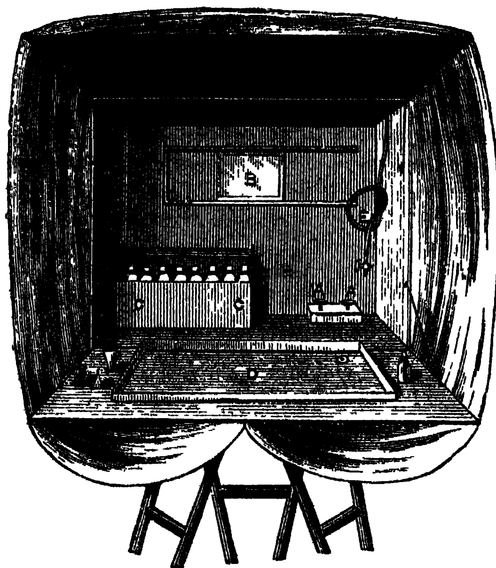


FIG. 6 THE BOX DARK TENT, COMPLETE.

roof; the lower door opens "flush" with the bottom of the box, and is used as a support for the sink The two doors shut down on a rabbet, one must be secured to the inside of the box with a bolt, and the other fastened to its companion with a lock In most, if not all, commercial box tents there is but one lid, which falls down altogether to form the bottom board. The roof is formed by a curtain supported by two iron rods When this plan is adopted the box can be very shallow, and the camera, &c., has to be carried apart from the tent. My tent, on the contrary, is made a little deeper, so as to carry all the apparatus except the tripods for the camera and tent, when travelling,

in itself, an arrangement which I am perhaps heterodox in preferring, but which my readers can modify or not as they please The measurements for a tent as shown in the engraving may be—length 2ft, height 18in, depth 6in or 7in For a tent with one door or lid, the depth need not be more than 4in To proceed with my description in the bottom of the box, at A A, is cut a slot, about 6in long and 1½in broad, according to the size of the bath it is required to hold The window is represented at B The sash should either be hinged or made to slide in grooves, as in the illustration Let us now turn to Fig 6, which represents the tent with its fittings in action The first point which attracts notice is the curtain This should be made of black "jeanette" lined with yellow It should be carefully tacked, so as to admit no ray of white light It need not be too voluminous, but only sufficient to shield the operator without cramping his manipulation It is a good plan to have the whole curtain converging like a bag to one point, where it can be drawn together by a tape, the ends of which can, during operations, be tied round the operator's waist At A A in its receptacle is seen the bath

An ordinary porcelain or glass bath can be used, and can rest obliquely in a cradle of non-actinic cloth, but as this necessitates double decantation and the inconvenience of an extra bottle, it is advisable to carry the solution in a "travelling" bath with water-tight and screwed top If the operator can afford it, he should also procure a dipper of pure silver wire The cost is about 12s, and, of course, breakage is next to impossible At B is the sliding window again, which should be opened as soon as the collodionised plate is safely in the bath, to let out the fumes of the collodion A case to hold bottles is shown at C C The necks of the bottles should be secured by intermediate wires to prevent contact with one another and consequent fracture. The case should be rendered compact by a slide at its top, to prevent the bottles falling out while travelling, and to serve as a support for odd bottles, &c, during operations It is best perhaps to use corked in preference to stoppered bottles Stoppers are liable to drop out unless very well ground, and are always subject to breakage To render the bottles in the case of an uniform height, blocks of wood of proportionate sizes should be placed at their bases. D represents the sink, which should be, if possible, of ebonite In one corner it should have a waste pipe, which penetrates the bottom of the tent and leads the water by means of a tube to the ground. At E is another tube, with a tap (an ordinary gas tap is serviceable), communicating with a tank or indiarubber bag, which rests on the top of the tent.

Besides these fittings a plate box or two (see Chap IX) will be necessary

I recommend my readers at the end of a day's work, before packing up the tent, to heat their negatives over a spirit lamp, and to varnish them there and then This course does away with the necessity for an extra plate box, and it is always satisfactory to think on returning home that one's work is virtually finished, and that nothing remains to be done but the printing If, however, the operator objects to this plan, he can use whichever of the plate boxes happens to be empty, to carry his measures, funnels, &c In some tents the receptacle for these is a fixture, but space is gained by having it movable, as, during operations, it can be laid on the ground or on the top of the tent If an indiarubber bag is not used for water, the zinc tank can be made with a lid, and the odds and ends of apparatus packed into it

Besides the usual complement of measures and funnels for large plates a pneumatic plateholder is required, to relieve the fingers of the weight, enhanced by the leverage attendant on holding it by the extreme corner, of a large sheet of glass Pneumatic plate holders are made of two different kinds, one in which the pneumatic attraction of the plate to a piece of indiarubber is caused by lowering a small lever, and which is known by the name of the "lever" form, the other in which the same result of attraction is obtained by merely squeezing the indiarubber ball which forms the lower part of the holder This is known as the "globe" holder, and is very handy for home use In the field the lever is perhaps more generally convenient

The legs of the tent-tripod should be removable from the slab or iron frame on to which the tent itself is screwed, the latter can then be carried in the tent, while the former may be strapped into one parcel along with the legs of the camera-tripod

If the operator finds his tent with all its appurtenances likely to tax his strength, especially when long journeys are attempted, he should devise a light "trolly" on wheels, which, while greatly facilitating carriage, is by no means difficult to construct or troublesome to put in action If the operator is lucky enough to possess a friend or attendant to help him with the tripods, and, if water be not within reach of the spot where the tent is pitched, with the water bag, such a convenience as the above mentioned may generally be dispensed with.

I shall now conclude this chapter with a few hints which may prove useful in several ways to those, especially the beginners, who are taking up the study of landscape photography.

One of the great secrets of success in landscape photography is to study a subject thoroughly before attempting to reproduce it with the camera and lens If possible, the photographer should visit the future scene of his operations some time before doing actual work there He should then carefully select such points of the surrounding landscape as he considers would make really satisfactory pictures, and study these individually and with the utmost care His motto should be that if a picture is worth taking at all, it is worth taking well Above all he should strive to make his productions not only evidences of manipulative skill, but witnesses to his artistic taste This is a point where ninety out of a hundred landscapists fail egregiously, and one to which the great artist photographers of the day are drawing the particular attention of their less successful brethren It is not enough to seize indiscriminately on every object which you think "will make a tidy picture," and then without more thought to prepare a plate, insert a tiny diaphragm in your lens so as to have the whole picture, distances and all, uniformly sharp, and finally to produce a tolerable printing negative. This is photography in one sense, but certainly not in its most elevated and elevating sense The photographer may be indignant if his performance of certain manipulations in connection with certain chemical agencies, is not freely admitted to be a form of "art," yet the truth is that "merely this and nothing more" is not art at all, any more than the man who produces a cast from a mould is an artist But more words would be superfluous. If you watch the artist photographer at his work and try to catch the spirit in which he works, or minutely analyse his finished pictures and place them side by side with the productions of the every-day landscapist, you will learn far more about the application of art to photography in an hour than you will gather from volumes of dissertation But do not suppose that because you are, or imagine you are, endowed with artistic perception and taste, you can be altogether independent of mechanical knowledge This is a great and often met with error The true path to excellence is to learn your manipulation thoroughly at home, to render yourself by careful and constant practice familiar with every article of apparatus in your employ, to acquaint yourself with the action of all the chemical compounds in your laboratory, and, above all, to acquire patience and determination. This done, you may with some conscience take the field, and learn your first lesson in the art-practice of landscape photography.

Having made up your mind to photograph on some fixed day, it will be well, as I said above, to begin by a previous visit to the spot where you think there is a prospect of obtaining satisfactory pictures. After selecting such points of interest as you consider likely to make

good photographs (in doing which care must be taken to bear in mind the distinction between the polychromatic hues of nature and the monochrome of the silver print on which nature is to be reproduced), it is a good plan to mark with sticks or stones the spots from which you roughly compute that each landscape will have to be focussed Now take the views separately, and map out as nearly as possible your plan of action Especial attention must first be paid to the disposition of light and shade throughout the pictures Having settled on such effects as your artistic taste, innate or acquired, suggests, note these carefully down, together with the time of day at which they may be secured, in a pocket-book kept for this particular purpose Note down also such alterations in the normal state of the landscapes as you may deem desirable , the addition of inanimate objects, such as branches of trees, the presence of a flock of sheep, a herd of oxen, a group of human beings, &c Remember that these three last require very delicate and skilful handling Their chief use is to relieve a meaningless expanse of foreground , but, to accomplish this properly you must never lose sight of nature or natural posture It is the preservation of the harmony of nature, and the total absence of any trace of artificial aid, that is the real criterion of success in an attempt to make what is inartistic accord with the principles of art

When such points as the above, in reference to your future landscapes, have been disposed of, attention should be turned to the mechanical arrangements which the production of the negatives will necessitate A primary consideration is the position of the tent This should obviously be as central as possible to the focussing stations of the various views If a running stream is at hand the tent should be pitched upon its banks The question of a handy and abundant water supply is a very important one in outdoor photography, and the operator should take especial care in making all previous arrangements with regard to it If a stream be not accessible, water may be obtained in pailsful from a neighbouring dwelling Should this source fail, the photographer must fall back upon himself and bring his water on his shoulders in an indiarubber bottle or bag

Before actually starting on your photographic expedition, make a point of going over your whole equipment to make sure that nothing is missing. To facilitate this, a list may be made of the articles required in one day's work, and be used as a muster-roll both for apparatus and chemicals Another plan is to go through mentally the operation of producing a negative away from home It is as well to carry along with one an extra measure, funnel, and so on, as the slight addition to the weight of the equipment is nothing compared with the pleasurable sensation of being on the safe side which the endurance of it gives.

The sensitising bath should be tried before starting Nothing is

more vexatious than to find, after a toilsome march of perhaps several miles, that a picture cannot possibly be taken without pinhole, fog, or other similar abominations New collodion should also be tested, especially if it is some prepared by another maker to the one usually patronised. I may here remark that nothing is more conducive to failure in landscape photography than the constant alteration of formulæ and chemical preparations "What is one man's meat is another man's poison" is a proverb the truth of which photographers are amongst the slowest of mortals to comprehend The only piece of advice to be given on this point may be summed up laconically into—find out the formulæ which lead you to excellence, and, as the Americans say, "freeze" to them.

Let the glass plates be thoroughly clean and bright, requiring only a touch of the camel's hair brush to render them fit to receive the collodion This exhortation to cleanliness applies to all parts of out-door apparatus, in which, from the necessarily small space available for manipulation, the smallest speck of dirt is almost felt

Let us suppose, however, that all difficulties have been overcome, and that everything is clean and in working order, and finally that the scene of operations is fairly reached The first task will be to pitch the tent upon the spot previously determined This perhaps occupies but ten minutes, but still it is better, if possible, not to move the tent until the day's work is completed, even though some of the focussing stations are rather remote The chances are that not only will the tent and apparatus have to be moved, but water will have to be fetched from the same place after all, or loss of time will be experienced in a variety of other ways.

When the tent is duly pitched and the apparatus unpacked and made ready for action, the landscape, for taking which the present is a favourable moment, may be focussed This is an operation which, apart from artistic considerations, would require some little practice to render the operator proficient In the first place he should remember to base his focus upon some point half way between the centre and the edge of the view as it appears on the focussing screen When this is perfectly sharp he can proceed to insert a diaphragm to impart a certain degree of sharpness to other points of the picture, which with the full aperture of the lens appear hazy and wanting in clearness of outline But I must caution my readers against the indiscriminate use of stops They are most valuable little instruments, it is true, but an undue employment of them often leads to inartistic effects. Look, for example, at the production of some ordinary landscape photographer Your first thought is one of admiration, and you exclaim "How exquisitely clear!" But after a

moment's reflection you find that this very clearness is a real disfigurement You look again, you see that the mountains miles away in the background are as bright and sharply outlined as objects which were not more than fifty yards from the lens You know well enough that this is not nature, and so did the photographer, but either the idea failed at the time to strike him, or, as is occasionally the case, he chose to ignore the fact altogether But this last is a habit I trust my readers will not be guilty of falling into Although a disregard for distances may be a widespread error, it is certainly not conducive to its removal to humour it, nor creditable in him who has the knowledge of what is artistically right to do violence to his opinions and those of the better informed among his critics, by producing pictures untrue to nature, and to the natural law that as an object recedes from view the distinctness of its outline is lessened to the eye Then, before yielding to the temptation of using the smallest of the stops, so as to make all sure, think of the gradation of distance you wish to reproduce, and you will find that to obtain your object, and at the same time to gratify your wish for sharpness, the largest, rather than the smallest, stop will be your choice

After focussing comes the preparation of the plate If some distance is to be traversed between the camera and the tent, it is advisable to lay a strip of blotting paper the whole length of the bottom side of the plate carrier A sheet of the same may also be laid at the back of the plate itself If a pneumatic plate holder be used in collodionising, the back of the plate should be wiped clean before it is allowed to enter the bath If this is not done, impurities will be constantly carried into the bath, which, from their minuteness, it will be difficult to eliminate

About the exposure in landscape, as in portrait photography, no fixed rule can be given. The stereotyped general rule is ,to expose for the shades and let the lights take care of themselves Among the former, trees hold a prominent position Their colour is highly non-actinic, and so requires a lengthened exposure

If, during exposure, a sudden gust of wind threatens to tear the whole landscape to rags, the cap can be at once put on the lens and removed to complete the exposure when the squall is over.

Never work, if you can by any means help it, with the sun in your face. Either at your side or at your back is its most manageable position If, however, facing the sun is unavoidable, a cap or hat should be held so as to screen it from flashing directly into the lens

With this I shall conclude my "hints" to those of my readers to whom landscape photography is either a present or a future study In develop-

ment and succeeding operations there is nothing which calls for special remark With good formulæ and plenty of practice failure in these is almost impossible But in the artistic treatment of a picture this is not the case No amount of formulæ will make a man an artist, but the simple explanation of the simplest of art rules will go far to give him a slight glimmering of artistic truth, and when this has once dawned upon him the daybreak is not so very far behind



CHAPTER XI

PAPER-PRINTING, WASHING, TONING, &c

THE present chapter is based upon an important assumption Hitherto my instructions have tended, I trust, consistently to the realisation of one fixed object, the production, namely, of satisfactory negatives From the hypothesis that these instructions have been accurately and successfully carried out, the *rationale* of the process I am about to describe will be deduced I have said elsewhere that from a negative by a process of sun-printing upon prepared paper, copies of a given subject can be indefinitely multiplied I will now proceed to justify this remark by giving in detail an account of the various operations which, combined with the possession of a decent negative or negatives, will procure the above-mentioned results.

The subject will require but little scientific preface The discussion of two points only will be sufficient to give the learner a grasp of the principles on which the theory and practice of paper-printing are founded These points are, firstly, the discrepancy, secondly, the analogy between the production of prints and that of negatives The discrepancy arises in the nature of the sensitive materials on the action of which both processes are respectively based In taking negatives the most ordinary agent is *iodide* of silver, in producing paper prints from them *chloride* of silver. The action of light upon the former of these I have fully exemplified. To illustrate its effect upon the latter, and to show how this effect is to be obtained, is the object of the present chapter But while this discrepancy exists in the nature of the sensitive materials themselves, there is a direct analogy in the manner in which the sensitive film or surface is in either case prepared Looking back to the wet collodion process for obtaining negatives, we shall find that a plate was coated with a substance (collodion) containing an iodide, this on immersion in the sensitising bath became impregnated with iodide of silver. In paper-printing the paper is treated with a substance containing a chloride and afterwards floated upon a bath of silver nitrate. This

produces a film of silver chloride which possesses the necessary property of darkening when exposed to actinic light

The most ordinary method of imparting the chloride to the paper is to coat it with albumen This gives an exquisite evenness of surface, and if carefully applied is a sure basis for successful prints Albumenised paper is an article of extensive commerce, and can almost invariably be procured of excellent quality (The paper itself is usually sold of two different qualities, *Rive* or *Saxe* The former is, on account of its brilliant gloss, more suitable for small pictures, the latter from its strength for prints of a larger size)

Having the paper at hand, and having fixed upon to-day or to-morrow for taking a turn in the printing department, the first question to be decided is the selection of the negatives to be printed from, the next, the number of prints required from each negative When the latter is settled and the quantity of paper which the total number of prints will consume has been calculated, the sheets can be cut into convenient sizes prior to their being floated upon the sensitising bath These sizes should be somewhat smaller than that of the dish in which the bath is to be contained, and at the same time must obviously be multiples of the size of the prints required If desired to print from nearly the whole surface of a quarter-plate, the albumenised paper can be cut into whole-plate sizes for sensitising, and afterwards sub-divided when required for the printing frame Four whole-plates will be found in every half sheet of commercial paper When cutting out paper for printing it will be found necessary to allow a slight space all round for trimming off the rough edges previous to mounting

(The bath in which the paper is to be sensitised should be made up in any quantity to the following proportions

Sensitising Bath for Paper

Nitrate of Silver		50gr
Distilled Water	...	1oz

It should be used in a porcelain dish, and when done with for the time can be filtered off into an ordinary bottle. When the solution becomes discoloured a little kaolin can be dropped into the bottle, and the whole well shaken; the kaolin having settled, the solution can be decanted or filtered off as required into the dish for ordinary use.)

As the strength of the solution becomes by use diminished, it is necessary to test it from time to time by an instrument called an argentometer. This is a bulbed tube containing quicksilver, which shows by index figures on its stem the number of grains of silver to the ounce of water in any solution in which it is immersed. When the argentometer shows a deficit of silver in the sensitising bath, all that is required is to drop

silver nitrate into the bath until the necessary number of grains to the ounce is once more indicated by the figure on the stem of the testing instrument appearing just over the surface of the solution The price of an argentometer is about half-a-crown.

Having prepared the sensitising bath according to the given formula and made ready the paper in flat pieces of a convenient size, the operator can now proceed to the task of making the paper sensitive to light This is done as follows: Pour the bath into a porcelain dish so as to allow a depth of not less than half an inch Now take one of the pieces of paper, albumen side downwards, by the extreme ends, between the finger and thumb of each hand, bring the hands together as if about to fold the paper, lower the paper until the centre of the albumenised surface just touches the solution, finally, bring down the ends gradually until the whole albumenised surface floats on the bath If this is done with care and due attention to the golden mean between hesitation and hurry, all air bubbles (which, if allowed to exist, will produce sharp round spots of white in the print) will be easily expelled When the paper has floated on (but not in any way immersed in) the solution for from three to four minutes, according to heat or coldness of the season, a pair of boxwood or ebonite forceps can be applied to a corner and the paper removed from the bath The pieces can now be fastened to American clips, and hung up away from dust to dry It is obvious that all operations connected with the sensitising of the paper and the subsequent drying should be performed in the dark room, or at least in non-actinic light. When the paper is dry it can be cut down to the sizes (leaving, as I have said above, some space for trimming) of the prints required This done the pieces can be stowed away for the time being in a light-tight box of any kind

With paper prepared as above, it will be necessary to proceed almost immediately to the printing, as the paper itself becomes discoloured even in the course of a few days. If desired to preserve it in its original whiteness for some weeks or even months, some special method of making it durable must be adopted. The best formulæ to produce this result are trade secrets; but the following, suggested by Mr Hopkins in the *Photographic News*, may be employed with success. Take any number of sheets of blotting paper and immerse them in a solution of carbonate of soda, about 30 grains to the ounce of water. When these have been dried insert between alternate sheets of blotting paper sheets of newly sensitised paper which have been almost thoroughly dried Put the pile under pressure and withdraw the sheets as from time to time required.

Another plan which can always be relied upon is to buy the paper

ready sensitised of some standard dealer It is, of course, compulsory that the sensitised paper of commerce should be very durable, and there are in the trade several secret processes by which this result is most successfully obtained A commercial paper which, while it keeps almost indefinitely, gives most brilliant prints, is that sent out in a sensitive state by C Durand, No 3, The Grove, New Wimbledon, S W That supplied by J Fallowfield, of 36, Lower Marsh, Lambeth, S E, is also of standard quality Ready sensitised paper can be purchased at about 15s the quire.

Let me now turn to the printing frame in which the sensitised paper is to be brought into contact with the negative. The ordinary teak wood frames, such as I have recommended for quarter-plate work, have merely rebates, on which the negative rests, and a jointed back, the pressure of which is accomplished by a couple of brass springs The frames for larger sizes have a front of plate glass, which allows any sized negative from the full size of the glass front downwards to be printed in the frame These have cross bars, and the pressure is given either with springs or screws The jointed back is on the same principle as that fitted to the little teak wood frames Its object is to allow the operator to watch the progress of the printing without disturbing the position of the paper How this is effected will be presently described

The construction of the printing frame having been discussed, I can now proceed to describe its practical application Place the frames face downwards, and clearing away the pressure springs or cross bars, remove the jointed back, in the rebates, or in the centre of the glass front, lay a negative, film side upwards, in immediate contact with the film place the sensitive surface of the prepared paper, at the back of the paper lay a strip of felt or blotting paper, and over this introduce the jointed back of the frame, finally, close the springs if the frame is a teak wood one, if one with cross bars and screws, shut down the former and give the pressure with the latter The preparations for printing are now complete, and all that remains is to carry out the frames containing the negatives, &c, and expose them face upwards to actinic light.

When the frames have once been taken out from the dark room into the open light, the operator, especially if the number of negatives printed be large, must be prepared to give them his undivided attention until the work he requires of them is completed. In the first place, he should exercise some judgment in assigning to the different frames their respective positions as regards the light in which they are to be exposed All the dense negatives may be printed in bright light, the thinner ones in the shade. When the printer imagines the light to be taking effect on the

sensitised paper he can examine the progress of the print in the following manner Take the frame into the shade and unfasten one of the two springs or bars which keep down the jointed back This will allow one half of the back to be pulled open, and half of the print can also be seen without disturbing the position of the other half, by pulling it back with the finger When the progress of one half of the print has been ascertained, the corresponding half of the jointed back can be shut down and the rest of the print viewed in exactly the same manner This course can be adopted with all the frames until the requisite degree of darkness has been attained by each individual print

With regard to the amount of exposure requisite for a vigorous and brilliant print, it is only necessary to say that the print (which at this stage is a dull red colour) should be allowed to remain in the frame until it is a few degrees darker in tone than that which it is wished for the finished picture to exhibit When this point is reached, the prints can be removed from the frame by undoing both the springs and lifting out the back entire, another piece of sensitised paper can then be laid over the face of the negative and the fastenings closed, as in the first instance The prints as they are removed from the frames must either be carried into the dark room or thrown into a light-tight box As soon as the number of prints required from a negative is complete, the negative itself should be stored away for fear of accidents, which, if the glass plates are allowed to lie carelessly strewed about, are at this stage very liable to occur

From the actual process of printing I will now proceed to the operations which unite to produce certain effects more prominently visible in the finished picture There are two principal points in which the print in its present stage is deficient (1) it is of a most crude and unpleasant "tone," (2) it is sensitive to actinic light, and if not kept away from its influence will turn uniformly black To remedy the first of these difficulties, the prints must be treated with the gold toning solution in the following manner Take a batch of the prints and wash them face downwards in two changes of ordinary water The washing, which must be done very thoroughly, will occupy about five minutes, the last change of water must be free from any trace of milkiness When by this washing the "free nitrate" has been removed from the prints, the latter are ready for immersion in the toning bath This is to be prepared according to one of the following standard formulæ —

TONING BATH (1)

Chloride of gold	1gr
Acetate of soda	30gr.
Water	8oz

This must be mixed at least a day before use. It will keep for almost any length of time, but occasionally requires strengthening; this may be

accomplished by adding as much gold as is necessary to start the toning action afresh. It is best to keep the stock of chloride of gold in solution, as in its original state it is very deliquescent, and is highly inconvenient for measuring off A good plan to adopt is to break open the small tube in which chloride of gold is usually to be obtained, and immediately to dissolve the gold in a certain proportion of water The proportion generally followed is 15gr of gold to 3¾oz of water, that is, 1gr of gold to every 2dr of water. To make up a toning bath according to the above formula, the acetate of soda (30gr) may be dissolved in 7oz 6dr of water, and 2dr of the gold solution added

The following is also a standard bath, which gives beautifully rich purple tones —

TONING BATH (2).

Chloride of gold	1gr
Phosphate of soda	20gr
Water	8oz

A drawback to the use of this bath is the fact that it must be used shortly after preparation

A third toning bath is the following, which keeps its power of giving excellent results for a very lengthened period

TONING BATH (3).

Chloride of gold	1gr
Chloride of lime	1gr
Prepared chalk	½ teaspoonful
Water	8oz.

The prints to be toned in this bath do not require a thorough preliminary washing, as the presence of a small quantity of free nitrate is desirable

During the immersion of the prints the bath containing the toning solution should be gently rocked, so as to allow the latter to have free access to all the prints The operator will also find it bad economy of time to attempt to tone more pictures at once than the bath will conveniently hold If the toning does not go on satisfactorily with the prints floating face upwards, they can be turned over on their faces, which is perhaps the preferable course of the two.

When the prints have lost their originally brick-red hue, and have acquired a suitable tone, they can be removed from the bath with the forceps and plunged into a dish of cold water to await the process of fixing If some time is to elapse before this takes place, the precaution may be taken of dropping into the water a few grains of common salt to retard the toning action, which would otherwise, though very slightly, be continued.

The strength of the fixing solution may be as follows

FIXING BATH FOR PRINTS.

Hypo-sulphite of soda	[illegible]oz.
Water	20ozs.

The prints should remain immersed in this bath for about a quarter of an hour They should be kept in pretty constant motion, and all air bubbles removed As hypo-sulphite of soda is extremely cheap, the amateur will find it best, and almost necessary, to throw away the bath when done with, and prepare a new one every printing day After fixing, it is requisite to remove by very thorough washing all the hypo-sulphite of soda from the prints themselves If this is not done the prints will rapidly fade away and become valueless The washing may be done in the following manner After a slight preliminary immersion they should be subjected, if possible, to a running stream of water for at least five hours If running water is not to be had, the time of washing should be increased to eight hours, and the water changed frequently

When the soda has been thoroughly removed, the prints can be dried between blotting paper and made ready for mounting The trimming can either be accomplished at this stage or immediately after the prints have been taken from the frame Perhaps the former is the more satisfactory course, as, during the long immersions the print has to go through, some papers are liable to distension, which, though slight, necessitates a second trimming, or materially detracts from the appearance of the mounted picture Glass shapes of different sizes for trimming are sold at the shops for from about 6d upwards, according to the size The cutting should be done with a knife, a special form of which adapted to this purpose can be bought for 9d or 1s In trimming large prints, or those with rounded corners, a most useful and handy little instrument is the Woodbury trimmer This has a cutting wheel mounted on a pivot, which will easily follow almost any curve

And now comes the operation of mounting, which, simple as it may seem to the inexperienced beginner, really requires some little care to render it successful. In the first place, it is necessary to fix upon a standard mounting solution. Perhaps that most generally used, particularly for small prints, is one compounded of starch and hot water The starch should be dissolved in water and used whilst warm, of a tolerably stiff consistency. It can be applied to the back of the picture with a brush or with a sponge Care should be taken to apply an even surface of paste, and to pick out or remove by application of a piece of blotting paper, all lumps or grit, which would, if they were allowed to remain, impart a very poor and unworkmanlike appearance to the print when mounted on the card When the whole of the back of the print has been thoroughly well rubbed with paste, it can be gently laid on the card or mount, the two top corners having been adjusted to their respective positions, and the rest of the print lowered into contact with the card surface. This done, and the print being exactly placed on the mount, a

piece of blotting paper can be laid over the former and the hand passed two or three times smartly over it This will expel the superfluous solution and give an even surface to the mounted picture.

Amongst other mounting *media*, besides starch paste, are dextrine and gelatine, both of which require, like starch, the addition of water. The latter requires a preliminary swelling with cold, and a final dissolution in warm water Ready made-up mounting solutions can be procured of any photographic dealer, that with the widest reputation is perhaps the "mounting medium" manufactured by Messrs Marion and Co, 22 and 23, Soho-square, W.

The choice of card mounts must be left to the taste of the photographer himself A buff coloured card with a gold or red line to show off the picture, answers admirably, and is moreover cheap A packet, containing a hundred of these to take cartes de visite, costs about two shillings, and from the neat appearance it gives to a print is an outlay where a slight saving need hardly be considered

When the print is firmly mounted upon its card it should be put under pressure for some little time, after which its production is virtually complete To confer, however, a highly finished appearance, the course is often adopted of burnishing the print by passing it under a heated or cold roller of steel Amongst the more pretentious class of rolling machines, suitable for pictures of large size, are Weston's Rotary Burnisher (to be had of J J Atkinson, 33 and 37, Manchester-street, Liverpool), and Entrekin's Oscillating Enameller (sold by Edwin Oborne, Red Lion-square, W C) J Solomon, of 22, Red Lion-square, also sells a strong well made machine, which is known as his "hot rolling press," complete with gas burner or spirit lamp for £3 (carte-de-visite size), or £4 for a press to take cabinet pictures An amateur, however, working in small sizes, will probably find a small double-geared rolling machine amply sufficient to meet his wants in every way These can be bought with two bright steel rollers and a screw for adjustment of the pressure for about 30s apiece To obviate the trouble attendant upon keeping the rollers bright and free from rust, these can be bought nickel-plated for a few shillings extra. This is a great advantage, as the nickel does not even tarnish, and can be cleaned with water alone.

In the larger machines there is generally a bed of steel, or thick glass, between which and the roller is passed the mounted print In smaller burnishers the card is introduced between two rollers, a suitable pressure adjusted, and a turn given with the handle. This forces the whole length of the card between the rollers, and, according to the extent of the pressure, imparts a brilliant and burnished appearance to the surface of the print.

Subsequently to rolling, or, as a partial substitute for it, many photographers are in the habit of applying a waxy substance, known as *Encaustic paste*, to the face of the picture. This can be bought in pots at the shops, or made up according to the following formula given in the *British Journal Photographic Almanac*

ENCAUSTIC PASTE

Pure Wax	500 parts
Gum Elemi	10 "
Benzole	200 "
Essence of Lavender	300 "
Oil of Spike	15 "

This paste is to be rubbed into the print with a tuft of cotton wool until a glossy and even surface is secured

I have now completed my description of the manner in which prints are to be in an ordinary way produced For the sake of brevity and directness I have reserved some few additional instructions as to producing peculiar varieties of pictures, such as vignettes, medallions, &c, together with some few hints observable in printing generally, for a subsequent chapter For the present the beginner will find plenty of occupation in practising printing even from a standard negative procured from a friend or shop Undignified as this may seem, it is a really capital course for the beginner to adopt, and far more reasonable than for him to waste good materials on producing prints, the faults of which he is slow to refer to the worthlessness of his first few negatives.

I must again remind my readers of the opportunity (alluded to in Chap II) afforded to amateurs and others of having their negatives printed from by professional printers To those who have barely time to produce the negatives themselves, it is a great boon to be able to reap the palpable fruits of the contents of the plate box they have laboured to fill, at a moderate expense, and with a far more satisfactory result than nine times out of ten they could themselves obtain

It will be a fit conclusion to this chapter to say a word about the two new sizes which the practice of printing has brought to light The first of these is *carte de visite*, which is the size of a print measuring when trimmed 3¾in by 2¼in, and the second is called a *cabinet* or album picture, which is a trimmed print, measuring 5½in by 4in In order to produce in the negative a picture suitable for reproduction in a certain printing size, it is a good plan to lay the glass trimming shape in the centre of the ground side of the focussing screen, and to draw a pencil round it. This is obviously as correct a guide of size in focussing as can possibly be followed.

CHAPTER XII

Varieties of Silver Prints—Hints on Printing

In my last chapter I gave an account "pure and simple" of the operations requisite to produce an ordinary print from an ordinary negative. In many instances the instructions there given would be sufficient to carry out the process with success, but there are certain cases in which, either from necessity or from a desire to add to the appearance of the print, some points in it must either be enlarged upon or modified For example; in the case of a negative of a bad landscape, or perhaps of a group, or even of a full-length portrait, it will be only necessary to follow out the line of instruction prescribed in Chap XI But in the case, say, of the kind of picture which is familiar to all under the name of *vignette*, it is obvious that some modification must be adopted. It is a common error to suppose that the vignetted appearance is given to a picture by some peculiar method of taking the negative, but this, except that the negative should only comprise the head and shoulders instead of the whole figure of the sitter, is not in any way the case. Vignettes, in common with medallions, domes, cushions, &c, are all produced in the course of printing, and as cases are constantly occurring where the addition of some such ornament has a material effect on the appearance of the finished picture, it is important that the amateur printer should be familiar with the modes of producing it.

I shall begin with the simplest kind of what I may almost call ornamental prints—those, namely, in which a clean white margin is shown in the print itself, giving to the latter a "domed" or "cushioned" shape. This effect is produced by the use of cut-out "masks" of black or non-actinic paper, which are either pasted on to the negative or used loosely. In the first case care should be taken to adjust the mask in exact truth with the objects shown in the negative, otherwise a permanent distortion will take place in all the prints. The mask must also be pasted on the collodion side of the plate. In the latter case, which involves a little inconvenience, but which has the advantage

that one mask can be used for any number of different negatives, the mask is laid loosely but accurately as before on the film side of the glass negative (for if the contact of a mask both with the film and the sensitised paper be not perfect, it is obvious that a "fuzzy" margin will result), and the sensitised paper is placed behind. The frame is closed down and exposed, and the print appears with a clean white margin of the shape exhibited by the cut-out portion of the mask.

From these I will proceed to medallions, which, though of the same nature as domes and cushions, and produced in the same way, are liable to certain modifications which are either unsuitable or impossible of application to those classes of pictures. Medallions are commonly of an oval shape, and are used, like vignettes, principally for showing up a head-and-shoulder portrait. The background for a medallion ought not to be too dark, as the resulting contrast is then disagreeably pronounced. Again, a simple medallion, where the picture is merely a clean oval set in a white "mounting," is rarely effective; it lacks relief, and its unnaturalness is too prominent to be pleasing. This, however, can be to a great extent removed by adopting a course like the following. Procure a cut-out medallion mask, and with it the paper oval corresponding to the inside of the cut-out. Paste the latter upon a piece of glass of a size corresponding to that you are employing for your negatives. Print from the negative with the cut-out mask, so as to produce an ordinary medallion picture. Now take the frame into the dark room and release the print. Lay the latter upon a handy flat surface, and over it superpose the plate with the paper oval. The oval must be in contact with the print, and must exactly coincide with the medallion produced by the cut-out mask. The glass plate will keep the print flat, and insure contact between it and the paper oval. The support, the print, and the oval can now be taken out into the open light, and exposed until the margin around the oval has been slightly darkened. On returning to the dark room the print can be released, and it will be found that the new mounting, which by toning can be made to assume almost any hue, has advantageously replaced the original white one. The above operation is called double-printing, and often proves of great service. Masks for the production of dome, cushion, and medallion pictures are obtainable of any photographic dealer. The amateur should procure, if possible, those manufactured for the trade by Mann and Fursman, as they are cut of very true and symmetrical forms and up to almost any dimensions.

The photographer should be careful to use his masks with judgment and taste, as, while the employment of them often leads to a most satis-

factory and pleasing result, their abuse is the cause of many feeble and inartistic effects

The course is often adopted of giving relief to a medallion, and occasionally to a vignette with darkened ground, in a very simple and decided manner After the picture has been mounted, the card is passed through a screw embossing press This is fitted with dies of suitable sizes, which, under pressure, produce corresponding reliefs in the mounted prints. Pictures embossed in this manner are called "cameos," and are often a great improvement on the flat surface of the ordinary card A "cameo" press, with dies, can be bought for about 10s or 12s

"Vignettes" require a separate explanation, as they are produced in a somewhat different manner from medallions and other ornamental prints where the masking is effected by paper with clean-cut edges. The chief feature in a vignette is the delicate softness of its edges, which adds peculiar effect to a comparatively large-sized reproduction of the head and shoulders. The instrument usually employed in making vignettes is that known as the vignetting-glass. This is a glass plate of any of the photographic sizes, the centre of the surface of which is transparent, but the edges of a deep ruby colour, which is very non-actinic This vignette-glass is laid over the glass side of the negative, either inside or outside the printing frame, in such a manner that the light will only be admitted to the sensitised paper through the oval or pear-shaped transparency in the centre of the plate As the contact is not perfect, the edges of the oval-shaped image on the print are not "clean," as in a medallion, and at the same time the edges of the transparency in the vignette-glass are so toned down with a due gradation of non-actinic colour, that the print is not irregularly "fuzzy," but rather exhibits a pleasing and regular softness

The vignette-glass is sometimes replaced in printing by vignette-papers, which can be procured of J D Waymouth, Nailsea, near Bristol, and of most dealers. Mr Waymouth sells a packet of twelve assorted for cartes at 2s The price of vignette-glasses of carte size is about 6d. apiece. It is necessary when printing vignettes with vignette glasses or papers to confine the exposure of the printing frames to the shade.

In taking the negatives for medallions and vignettes, of course only the head and shoulders of the sitter need be reproduced The sitter should be so focussed that his or her mouth will appear as nearly as possible in the centre of the negative. Unless this is done, the negative will not tally well with the vignetting-glass, and much difficulty in adjusting the latter will be experienced.

And now for some few hints as to the practice of paper printing

generally. The common error incidental to beginners in this branch of photography is the idea that it is wholly comprised by a few purely mechanical operations. In some cases, it is true, the process of printing does not seem capable of admitting the assistance of artistic treatment, but a very limited experience will show what a cramped view this is to take of the subject The only time when a printer can hardly help producing standard pictures is when he is working with negatives of the very highest order And even then improvement can almost always be wrought, if the printer really knows his work, in a hundred little ways, the effect of which may scarcely be missed if absent, but cannot when present fail to be appreciated To take a practical instance, let us consider the treatment of a standard portrait negative The every-day printer merely lays it in a frame and exposes, tones, and fixes as many pieces of paper as he deems necessary to convert into what he calls pictures, if they turn out well, it is no credit to him The due gradation of light and shade, the harmonious modelling of the features, are no witnesses to his judgment or taste All that is good in the picture comes from the negative, but there is no trace of improvement effected or ornament added during the time it has been in the printer's hands But give the negative into the charge of the man who knows his work, and is what he professes to be, an artist, and, little room though there be for improvement, he will fill it up If he can find nothing else, he will operate on the face. He will make nature's work more natural by making her almost paint as well as draw in monochrome A brunette's face, instead of "coming out" an expressionless grey, will be coaxed by toning into a suggestion of its real colour A fair-haired, white-clad figure will be watched with the minutest attention, so that it does not transgress by a minute's excess of exposure the light airiness which is its prominent charm. At the same time no feebleness from under-printing will be visible, but the whole picture will stand out rounded, harmonious, and natural to the eye, and toned down into a perfect study of black, or rather grey, and white In a word, the printer will do justice to the taker of the negative, and the two combined will do justice to their common model, Nature

In the case of printing from good negatives I have only been able to give examples; it is impossible, in such circumstances, to dole out instruction in cut-and-dried rules and stereotyped formulæ But it will readily be imagined that if improvement can be effected by judicious printing in pictures from good negatives, *à fortiori* the printer's power is proportionally widened when he has to deal with bad ones Let us take the case of a negative where the lights and shades are harshly contrasted. Taking the use of masks as a precedent, we shall find a

layer of cotton-wool or tissue-paper, spread judiciously on the glass face of the negative, will bring down the density of a shade in a most satisfactory manner. A white face, which instinctively reminds one of a clean napkin with a few holes in it, can be wondrously improved by pasting over the glass side of the negative a piece of tissue-paper with a hole just over the ghostly features in question The face is thus printed slightly in advance of the rest of the picture, and begins to assume some show of expression In a like manner masks can be applied to any part which shows a disposition to print down into a deep unyielding black

I have already hinted at the advisability of printing weak negatives in the shade and strong ones in the sun The printer will sometimes find it beneficial to employ a slightly stronger sensitising bath than the ordinary one for paper that is to be used for prints from thin negatives, and, *vice versâ*, a weaker one in the case of negatives where great density is apparent

The question of toning, although it exercises a powerful influence for good or evil over the finished picture, must be left altogether to the good taste of the printer There are two extremes, however, which he should learn from the first to avoid The first of these is mealiness, that is, when a print looks as if it had been operated on with a scrubbing-brush and soft soap The other is harshness or crudity In this case the tone is hard and possesses no flexibility, the whole picture is a mass of rugged whites and blacks or browns "Whoever loves the golden mean" will produce no prints of this stamp, or at least, if he does, will hesitate to declare his incapacity by showing them

In some instances very pleasing effects can be obtained by using delicately tinted paper for the prints This can be procured of almost any dealer in albumenised papers, the most usual colours are pink and light mauve Their employment with thin negatives is often productive of good results Another method of giving a colour effect to a print is to dip it in a weak solution of some aniline dye, such as that manufactured by Judson. By immersion in a weak solution of blue dye, an effect something approaching moonlight may be obtained

Finally, let me advise the amateur silver printer never to rest satisfied with himself Let him always be ready to appreciate excellence in others, and to draw hints therefrom to adapt to his own practice. There is a lesson for the beginner to learn in every picture sent out by a really good photographer Let the former be proud to buy the productions of the latter, and to pick out and analyse each little dodge or cleverness which leads to some dainty effect, or adds another link in

the chain of harmony which composes a real picture Let the portraits from some well-known gallery be examined for the sake of hints on suppression of harsh contrasts and perfect adaptation of tone Let the landscapes of some great photographic artist be made to show how careful printing can be superadded to careful lighting and manipulation of the negative Let the printer first perfect himself in obtaining creditable prints from standard negatives, and lastly complete his education by seeing how good a print a poor negative in his hands may be made to yield The latter is a crucial test which many who think themselves good printers would be at a loss to stand The greater credit therefore remains to him who can do so, and with it the consciousness that he is a master of his art, and, so far as is possible, is prepared to withstand any accident its practice may entail



CHAPTER XIII

Enamelling Silver Prints.

In Chapter XI it will be remembered that instruction was given concerning a species of glaze communicated to the surface of a print by means of a roller or rollers of steel, combined with powerful pressure This glaze was not very pronounced, it was rather of the nature of polish or of the burnish applied to metal I am now about to describe the process of applying to a print a glaze of a different nature, and produced in a different manner. My instructions will teach readers how to give their prints a brilliant and mirror like surface, not unlike that exhibited by enamel, hence "enamelling" is the name that has been given to the process by which this end is to be gained I must preface any practical intraction by a few remarks upon the use and abuse of enamelling With regard to the latter, the printer must reflect, before applying such a powerful addition to the effect of a picture as the mere fact of changing a "matt" surface into a most brilliantly glassy one implies, whether this addition is in every case a beneficial one Take, for instance, a perfect vignette where the whole charm of the picture lies in its tranquil softness, the effect of this is lost by turning it into an enamel But, on the other hand, there are many cases where the enamelled surface, one of the chief uses of which is to heighten the detail of a picture, adds a lustre and brilliancy to the minor surroundings of a print, which are instinctively seen to be wanting in an ordinary matt surface Again, it is a powerful argument in favour of enamelling, that the film of glaze undoubtedly affords decided protection to the print itself from the deteriorating influences of the outer air On the understanding, then, that enamelling prints, like most artificial additions to the normal condition of anything, has its good and its bad side, and that the printer must not hope to successfully invoke its aid without being fully prepared to exercise those well-worn attributes of the photographer, judgment and taste, we will proceed to the details of our process and their practical application.

The necessary apparatus and chemicals for enamelling are very simple.

The following is a full list of those required in the ordinary process, one or two extras may be needed in modifications or improvements, which will be mentioned and explained under their respective heads The first indispensable is a bottle of uniodised or enamel collodion It will be best for the young printer to buy this ready prepared, which he can do at any of the shops An ounce of gelatine will also be requisite That manufactured by Nelson is perfectly adapted to the purpose, and can be procured of any chemist The only piece of real apparatus needful is a "squeegee," which is a band of thick indiarubber set in a slip of wood, it costs from 2s 6d. to 4s Besides this, a certain quantity of glass plates of good quality and free from scratches will be needful to form a basis for the enamel film

I may mention before entering upon the details of my subject that the standard work on enamelling is that of M Piquepé, entitled "Enamelling and Retouching in Photography" The publishers are Messrs Piper and Carter, of Gough-square, Fleet-street, E.C, the price is half-a-crown On this work is based the present chapter The printer should also consult the able and practical paper on enamelling by Mr Henry Cooper, in the "Year Book of Photography for 1877," from which I have also derived many very valuable hints.

To begin work, as many glass plates as you require enamels must be carefully selected These should be cut of rather larger dimensions than the print itself, thus, for cartes de visite, quarter-plate glasses will be just the thing, for cabinets, half-plates, and so on With a little practice the printer will find that he can enamel two cartes on one half-plate glass, but he should begin by working them singly

The glass plates can now be coated with the enamel collodion and allowed to dry, this may take half an hour While the drying is going on, it is well to prepare the necessary solution of gelatine in the following manner Take as much gelatine as is likely, when dissolved in the proportion of one drachm to three ounces of water, to be sufficient for a given number of plates, and put it into a strong bottle with as much cold water as will just cover it In a short time the gelatine will become swelled If boiling water is added, the whole will rapidly dissolve and be ready for use

The dry collodionised plates must now be coated with the gelatine solution. If the latter is not clear, it can be filtered through fine muslin into another bottle. From this it can be poured, while warm, over the collodionised plate. This may not be found quite easy at first, but will become so after one or two trials, and a little of the solution spilt is a matter of very trivial importance.

The gelatine film, like the collodion one, must be left to dry, and may

either be used directly it becomes so, or be reserved, by storing away the plates in an ordinary plate box, until further use This is very convenient, as any number of plates can be prepared at one time and be ready to hand at a moment's notice—perhaps several months hereafter

Supposing then an adequate number of collodio-gelatinised plates to have been prepared, let us proceed to the process of enamelling the prints, or, in other words, of transferring the gelatine pellicle to the face of the print The most simple method of accomplishing this is to take the plate in one hand, the untrimmed print in the other, plunge them both into clean cold water, bring the face of the print into contact with the gelatine film on the plate, and remove both print and plate simultaneously from the water Now pass the squeegee over the back of the print to exclude all air-bubbles and to render the contact perfect

Mr Cooper recommends the precaution of rendering the gelatine pellicle insoluble by immersing the dried gelatinised plate before transferring it with the print to the cold water, in a solution of chrome-alum, one grain to the ounce of water.

M Piquepé coats the plates a second time with gelatine, and, moreover, dips the print into a solution of gelatine before laying it over the face of the plate In this process the immersion into cold water is dispensed with M Piquepé avers that the greater number of gelatinous films the plate receives "the greater will be the depth, strength, brilliancy, and delicacy of the enamel." The cold-water transference, however, while perhaps not losing in efficacy, gains very much in ease and simplicity

A third plan, mentioned by Mr Cooper is not to coat the collodionised plates with gelatine, but to dip the print in the gelatine solution, and to lay it down on the mere collodion surface Contact is then rendered perfect as before with the squeegee.

When the print has been by any of the above methods caused by the pressure of the squeegee to adhere firmly to the collodio-gelatinised plate, it will be necessary to apply the card support to the back of the print. To accomplish this, take a card and cut it to a size smaller all round than the print. The card itself should be a thin one, and neither toned nor gilded Immerse it in hot water to soften it, and afterwards in a solution of gelatine in water (prepared in the manner described above), about two drachms of the former to every three ounces of the latter Lay the gelatinised card on the back of the print and apply the squeegee. The plate with the print and cardboard support can now be laid aside in some moderately warm room to dry

When the drying has been thoroughly concluded, which may take from eight to twenty-four hours (overdrying being impossible), the point of a penknife may be run round the print, which can then be detached from

the glass, bringing away the collodio-gelatine pellicle along with it. The print will thus exhibit a brilliant enamel-like surface, which, as observed before, will not only heighten in a material degree the details of the picture, but will be highly conducive to its permanence

When the enamelled cards have reached this stage, they may be simply trimmed round, and in one sense considered finished But as M Piqupée says, the work in this state, owing to the probable dirtiness of the backs of the cards, and the fact that as the print is enamelled all over it cannot be handled with impunity, hardly presents a sufficiently neat appearance And so the following method of operation recommends itself as productive of more satisfactory and artistic results In the first place it is necessary to trim the enamelled cards to the size of an ordinary print This is best done by laying the cutting shape upon the card, adjusting it to a correct position, holding the card and shape between the thumb and fingers of the left hand, and cutting round the card with a pair of scissors in the right Some strong mounting cards of double thickness should now be procured, and the enamels, after receiving a coating of hot glue, can be applied to them When a piece of tissue paper has been pasted at one end of the mount so as to overlap and protect the face of the enamel, the operations connected with the production of the latter are complete

If it be desired to emboss an enamel, this should be done before mounting The enamel card is passed through the press, a piece of paper laid in the centre of the mount to keep up the relief, and only the edges of the enamel card treated with the glue.

In some cases it is requisite to "spot out" the prints before enamelling Owing to the subsequent immersion, &c, of the print, it is obviously impossible to employ Indian ink or the ordinary pigments which are soluble in water The following method of procuring an insoluble pigment is that employed by Mr Henry Cooper, and described by him in the article referred to previously Mr Cooper's own words are so practical and so straightforwardly clear that I should wrong them and him by attempting to torture them into mine · "The plan," he says, "is based upon the well-known fact that gelatine in the presence of a minute quantity of chrome alum becomes quite insoluble in even hot water.

"I make two solutions :

No 1.	Chrome alum	10grs
	Water	10oz
No 2.	Nelson's gelatine	½oz
	Carbolic acid.	10 drops
	Alcohol	½oz.
	Water	6oz

"When about to touch some prints, solution No. 2 is warmed, and a

small quantity is mixed with the pigment on the palette, which must be kept gently warm. A little of the alum solution is now added, and with this mixture the prints are worked up as much as may be required To prevent the gelatinising of the pigment at the point of the brush, the print must be kept slightly warm, which is easily managed by laying it down on a thick sheet of glass previously heated, or in many other ways which will readily suggest themselves After a little practice no more difficulty will be found in working with this gelatinous mixture than with ordinary water-colour paint, and when once dry every touch will be immovable by washing either in hot or cold water

"One or two little details are of some importance The first is that the mixture of gelatine, pigment, and alum must on no account be allowed to set or dry whilst in use, as, once dry, it is insoluble, and, once set to a jelly, it is not liquefied again by heat The second is that the same precaution must be taken with the brush used I find the best plan is to use a palette of the saucer or watch glass form, and to stand it in a vessel of warm water, and always to use hot water for diluting the paint and rinsing the brush"

Instead of the pigment, in combination with solution No 2, Mr Cooper remarks that a small fragment of Autotype tissue can be employed as a convenient substitute What Autotype or carbon tissue is will be explained farther on As regards the practical adaptation of Mr Cooper's remark to enamelling, "the bit of tissue is soaked in cold water for a few minutes, and then placed in the little saucer palette, and heat applied, when the coating (consisting of pigment, gelatine, sugar, &c) will melt and the alum solution can be added."

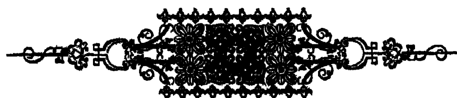
The following is a simple method, recommended some little time ago in the "Photographic News," by Mr Henry Knight, of enamelling prints with ordinary negative collodion Make up the following

WAX SOLUTION

White wax	10gr
Methylated ether . ..	1oz

Cut the wax up fine, and after the addition of the ether, shake until solution takes place The solution will be milky, but does not require filtering Pour a few drops of it on to a glass plate and rub bright with a chamois leather Coat with ordinary negative collodion, and when the film is set hard (which will be in about five minutes), immerse or wash it under a tap until the greasiness has disappeared It is then allowed to dry spontaneously, or by the aid of heat A solution is now made in the ordinary way of gelatine, thirty grains to the ounce of water, which, after straining through fine muslin, is poured while warm over the dried collodionised plate If the solution does not flow evenly, it can be

guided over the surface of the glass with a camel's hair brush or a strip of paper. The plate is rested on a level surface until the gelatine is set (*i e*, in about ten minutes' time), and then plunged, as in the ordinary enamelling process, along with the print, into a dish of cold water The face of the print, is brought, while under water, into contact with the gelatinous film, and on their simultaneous withdrawal from the water, the palm of the hand, or, better, the squegee, is applied to insure the perfect contact This done, it is treated as if it were an ordinary enamel produced with special enamel collodion



CHAPTER XIV.

Collodio-chloride of Silver—Plain Salted Paper—Ferro-prussiate Paper.

Having described at some length the process of printing in silver on albumenized paper, I will now proceed to discuss other methods of printing, in which the application of a substratum of albumen to the paper ceases to be a necessity. Foremost amongst these comes the process of printing with Collodio-chloride of silver, which was introduced to the photographic public about seven years ago, by Mr G. Wharton Simpson, the editor of the *Photographic News* The following formulæ and method of operation are taken from the account of the process, as published by the inventor himself and described in the *Year Book of Photography* for 1871, and in the American publication, *The Silver Sunbeam*, published by Messrs Anthony and Co., of New York, and Messrs Trübner and Co., of 59, Ludgate Hill, London, E C. The first requisite in the process of producing the collodio-chloride, or, rather, of impregnating a certain quantity of collodion with chloride of silver, is the collodion itself. This must be *plain*, and can either be purchased or made up in a stock solution, according to the following formula —

Plain Collodion.

Alcohol	5oz
Ether	5oz
Pyroxyline (gun-cotton)	60grs.

Shake the mixture until the gun cotton is dissolved, and set aside for a few days to settle. The clear collodion can then be decanted off into another bottle for use Now prepare three further solutions as below —

No 1. Nitrate of Silver Solution.

Nitrate of silver . .	1dr.
Distilled water.	1dr.

No 2. Chloride of Strontium Solution

Chloride of strontium	64gr.
Alcohol	2oz.

No. 3. Citric Acid Solution.

Citric acid	64gr
Alcohol	2oz.

Thirty drops of No. 1 solution are now mixed with one drachm of alcohol, and added to every 2oz of collodion required to be converted into collodio-chloride Next 1dr of No 2 solution is poured in gradually, accompanied by constant agitation, lastly, half a drachm of No 3 is added, and in a quarter of an hour the whole is fit for use

The paper to which the collodio-chloride is to be applied must be well sized in order to prevent the absorbence into its fibres of the coating solution A sizing of gum tragacanth is recommended by Mr. Wharton Simpson

Before coating, the paper, which should be cut in sizes rather larger all round than the cutting-shape, must be made into a kind of little tray, in order to facilitate the application of the collodio-chloride solution This is done by turning up the edges all round for an eighth of an inch, and leaving a corner from which to pour away the refuse solution The paper is then attached by pins at the corners to a flat board, and coated just as an ordinary glass plate is coated with ordinary collodion When thoroughly dried it may be brought into contact with the negative in an ordinary printing frame.

When the printing, which should be carried rather farther than with albumenized paper, is accomplished, the print can be removed from the frame, subjected to a slight washing, and immersed in a toning solution such as the one for which the first formula was given in Chap XI. An old and weakened sample of this gives preferable results to a newly-mixed one When toned, the print may be fixed in a hypo bath as follows

FIXING BATH.

Hyposulphite of soda ..	3oz
Water .. .	20oz (1 pint).

After an immersion of five or six minutes in this solution, the print can be finally subjected to a stream of water from the tap for the same duration of time, and then needs but drying and trimming to complete the process of its production.

Apart from its power of giving brilliant prints upon paper, collodio-chloride of silver is often used for producing in a similar manner prints upon glass. The kind of glass usually employed is *opal*, and has the appearance of fine white porcelain. The process of producing prints upon this surface is called *opalotype*, and gives very beautiful results An edging of dilute albumen is run with a brush all round the ground side of the plate, and when this is dry the plate is coated exactly as if with collodion, with the collodio-chloride of silver. This film is in turn dried before a bright fire, and subsequently allowed to cool It is then ready for transference to the printing-frame.

The printing-frames employed in opalotype are generally of a different

kind from those used in ordinary printing The reason for this is that in the latter the progress of the print cannot (unless indeed the simple method proposed by Captain Abney, of connecting negative and sensitised plate by a strip of paper pasted along the corresponding edges of both, is adopted) be satisfactorily watched. The special frames for opalotype are very ingenious and convenient Cox, of 26, Ludgate Hill, sells one of quarter-plate size for 7s

The operations of toning, fixing, &c, an opal plate sensitised with collodio-chloride of silver are conducted in the same manner as in the case of a print in the same sensitive material on paper

To those who are unable or unwilling to prepare the collodio-chloride for themselves, it may be gratifying to know that they can purchase it ready prepared of any photographic chemist, at the rate of about 10oz. for 5s

Besides collodio-chloride of silver there are other methods of printing in which the albumen substratum is dispensed with Amongst these is the process of printing upon plain salted paper, which is prepared as follows. A salting solution is made up according to the proportions given below —

SALTING SOLUTION.

Chloride of ammonium	100gr
Gelatine	10gr
Water	10oz

The gelatine is allowed to swell in cold water, which is poured off The water prescribed in the formula is now heated and the swollen gelatine dissolved in it After filtration it is poured into a tray, and the paper required to be salted floated upon its surface for about three minutes It is a good plan to use for the purpose the *wrong* side of ordinary albumenised paper.

Positive ferro-prussiate paper for copying drawings, maps, plans, &c, can be procured of Marion and Co., 22, Soho-square It is sold in rolls measuring a little more than 2ft wide by nearly 11 yards long, at 10s. per roll. It simply requires exposure in the frame under the drawing or other object which it is desired to copy, and washing in cold water. It shows the copy in white lines on a blue ground. Ferro-prussiate paper is also sold by the Sciopticon Company, 157A, Great Portland-street, W., who advertise a manual on the subject.

I shall not enter at present into "printing by development," as it is not very extensively practised in ordinary printing from negatives, and will come in more *àpropos* of a subject, the discussion of which must necessarily be postponed. Readers will find it under the head of "Enlarging Processes."

CHAPTER XV.

Clouds in Landscapes

Few who have indulged in the most fleeting glimpse at the contents of a picture gallery have failed to recognise the prominence given by the artist in almost every landscape to the representation of the sky None gifted with the most ordinary powers of observation can deny the effect of *natural* clouds upon the most humble picture and yet in the face of these facts it is only of late that photography, which in almost every other sense may be fairly looked upon as Nature's most faithful pencil, has attempted anything more than skies composed of an expanse of glaring white To an outsider this seemed ridiculous "If you reproduce objects of view on the land, why can't you do the same for those in the sky?" seemed a highly reasonable question The photographer rejoins that he can, and now does reproduce clouds by his art, but that in many cases he finds it impossible to reproduce them simultaneously with objects on the land A simple explanation will set this right If you direct a camera and lens towards a group of fleecy clouds, and expose a sensitive wet plate for a minute or more, the result will be one mass of uniform shade in the negative, which will produce in the print nothing In other words, you will obtain a sky (?) the exact counterpart of those glaring unprinted portions of the paper which a few years ago ruined the effect of almost every landscape photograph You are quite ready with the obvious reason for this the plate, you say, was exposed far too long for the highly actinic colour of the clouds, and the detail of the latter was merged by the over-exposure into uniformity A result precisely analogous to this is obtained by leaving a thin negative superposed upon a piece of sensitised paper, exposed to actinic light for a lengthened period. The thin negative corresponds to the delicate actinic tracery of the clouds, the sensitised paper to the sensitive plate. In either case the result is unnatural uniformity of tone. To continue your investigation, lower your camera

a little so as to include in your picture some part of the landscape proper, such as a clump of trees, for instance, which, as I have explained elsewhere, have an essentially *non*-actinic colour With a minute's exposure your sky will come out in the negative exactly as before—uniformly black—but your trees will probably be full of the minutest detail, showing, as far as they are concerned, a correctly timed exposure Finally, direct your camera once more to the clouds alone, and expose almost instantaneously By this you will doubtless secure a delightful piece of sky (or "cloud-negative," as you will, when you have learnt its use, prefer to call it), full of airy softness, yet with the same fulness and roundness which correct exposure and good lighting give to more ordinary and substantial objects. With the lesson which the production of these three negatives have taught you, you are now thoroughly competent to grapple with the subject of clouds in photographic landscapes In a word, you have found the colour of clouds is so highly actinic that, photographically speaking, it is unmanageably in advance of almost all the rest of the picture, hence that the simultaneous production of the two by the every day appliances of photography is at present unattainable. As, however, the presence of clouds in the majority of landscapes is, from an artistic point of view, a *sine quâ non*, the photographer must learn to produce them, if not in conjunction with the original negative, by the aid of supplementary contrivances, the nature of which I will explain.

Let us suppose, then, for the sake of convenient reference, that we have before us a landscape negative, perfect in all respects, with the exception of its so-called sky. It is into this sky we are desirous of infusing a little of that fulness and variety which we admire in natural skies and even in those of good drawings, but which are in our negatives conspicuous only by their absence.

The first on the list of cloud-making processes is one which does not require very lengthy mention, as, so far as its principle goes, it is commendably simple. In one word, its object is to produce clouds that are essentially artificial. Whether they are artistic depends entirely upon the talent of the operator. The process consists in putting the clouds into the negative by hand. To admit of this the original sky in the negative should not be completely opaque, otherwise no alteration, except that effected by the reduction of its intensity in different parts, would affect the sky of the print The sky should, on the contrary, be of a modified opacity, producing rather slight shade than otherwise. It is obvious that if a dab of really non-actinic colour be applied to the middle of such a sky as this, the result, in the print, would be a rough imitation of the sun in the midst of a thunderstorm. Without attempting

such an ambitious effect at present, it will be seen that an artist has it in his power to convert this crude dab of white into a beautifully fleecy bank of clouds in the midst of a sky a shade darker in tone than themselves. And so, with a brush, charged with non-actinic colour, he roughly sketches out those portions which he wishes to be absolutely white, and softens down the edges with colour, the non-actinic properties of which are not so powerful. Wherever he wishes the sky in the print to be a trifle shaded he leaves the original sky of the negative untouched. What retouching he does give, is given to the glass side of the negative for obvious reasons The operation requires considerable artistic skill to produce really satisfactory and natural results, but has the advantage of being conclusive—once done it is done for ever, and with one printing the landscape is complete, with its clouds more or less successfully adding to its general effect

We now come to processes where the clouds are inserted into the landscape by what is known as double-printing For this the chief requisite is a cloud-negative such as that mentioned above The photographer can either make this himself or purchase it ready made The cloud-negatives with perhaps the greatest reputation in the market are prepared by Sergeant W Perry, of Hythe, Kent The operation of printing-in a sky with a cloud-negative is very simple The original landscape is printed in the ordinary way, with its sky uniformly white, or nearly so The print is then taken from the frame and laid upon a level surface, such as a piece of glass. A cloud negative of a character suitable to the landscape is selected, and laid on the face of the print in such a manner that the clouds are properly disposed over the amount of sky at the printer's disposal Mr. Perry's cloud-negatives are not on glass but on fine textureless transparent paper, and thus will require the superposition of a glass plate to keep them and the print in proper contact The outline of the landscape can now be roughly masked out with a handkerchief or duster, so as to allow only the sky to be exposed to the light The support, the print, and the cloud-negative with the mask are now taken out into direct sunlight for perhaps twenty seconds On removing the cloud-negative it will be seen that the clouds have been printed-in on the original landscape in the most effective, and, if the cloud-negative has been suitably selected, in the most natural manner. The chief drawback to this process is the fact that each print requires a separate clouding; but the results in the hands of a skilful and artistic operator are such as will well justify the slight amount of extra trouble spent in their production.

Another plan of operation in working with a cloud-negative is that proposed by Mr. R. V. Harman. This gentleman describes in the *British*

Photographic Journal Almanac his mode of procedure in the following words "Having adjusted the print to the most suitable portion of the cloud-negative by holding them up to the light, I hold both negative and print in my left hand, thumb on the negative, and fingers extending over the back of the print. With a camel's hair brush charged with dilute moist colour I roughly trace the outline of the landscape on the negative, and place the same with the print attached in a pressure frame with plate glass, a size larger than the negative itself Having fixed the back of the frame, turn it up, and the water colour line will be distinctly seen through the plate glass Now lay a sheet of glass over the face of the frame, sufficiently large to rest on the woodwork, and on this arrange a cloth or duster so as just to cover the water colour line, taking care, at the same time, to cover the landscape portion of the print The frame may now be put out to print in the usual way, and can be looked at as often as necessary while printing, and the cloth instantly readjusted without the least trouble . By breathing on the glass the water colour line can be instantly wiped off and another substituted for a different subject The frame must, of course, lie in a horizontal position during printing, and may be placed in any light, either feeble or strong, *but not in the sun*"

It is advisable, when using a cloth or a duster as a mask in cloud printing, to move it slightly during the exposure of the negative, as otherwise a sharp line will frequently separate the landscape from the clouded sky.

A final method of obtaining clouds for landscapes is, when taking the original negatives for the latter, to take second negatives for the former from exactly the same point of view It is very little extra trouble, after securing a landscape the natural sky of which is really its prominent feature, to rapidly expose another plate for the clouds To make use of this of course double-printing will have to be resorted to A cloud-negative obtained by these means is obviously more easy to work with, and, above all, productive of far more natural results than, nine times out of ten, accrue to one whose affinity with the landscape in question is only determined by the number of cloud-subjects at the printer's disposal, and his artistic taste in making a selection

Talking of artistic taste in reference to clouds, it is curious to note how limited popular ideas on this subject only too frequently are. Beginners cannot be too strongly warned against decorating their skies with abnormal ornaments which are no more in keeping with the subject of their picture than dabs of black paint on the features of an Englishman. What can be more absurd than a landscape basking in a delicious glow of sunlight and surmounted with heavy banks of

lowering thunder clouds? And yet this is a mild type of the errors into which the cloud-printer who has not his brains as well as his fingers in his work is liable to fall White skies are unnatural enough, but they can hardly be worse than unnaturally clouded ones Without, however, going further into the subject of the artistic treatment of clouds, I should like to offer a practical hint which may prove useful to the beginner Cloud-negatives to an unpractised eye are very deceptive objects, and frequently it is very hard to determine the manner in which the clouds will "come out" Hereby the hasty tyro is led to make an equally hasty choice, and the result is one of the inartistic combinations mentioned above This is completely obviated by pulling prints from each cloud negative at one's disposal These toned and fixed often form a far more satisfactory and reliable criterion of the qualifications of a cloud-negative than the negative itself



CHAPTER XVI

Appendix to the Wet Collodion Process

In the production of a work like the present there are two points of especial importance which not only require to be carefully considered but also to be considered simultaneously The first of these, of course, is the amount of information conveyed, the second is the manner in which the conveyance is accomplished Scanty information, however well arranged, is of scanty use, but copious information, combined with ill-arrangement, is downright injury In the case of "Practical Photography" information has been forthcoming in plenty, but the projection of it into a form at once readable and affording convenient reference has not been attempted without some trouble and care The outlines of the plan which we have adopted are as follows In the first place, it seemed advisable to divide the work into, say, three separate parts The first of these was to comprise the Wet Collodion process, together with that of printing in silver These two processes include the operations requisite in producing the ordinary pictures which we meet with in albums and elsewhere The second part contains full instructions for producing negatives from dried films, and the preparation of the latter—processes which may be grouped under the collective designation of "Dry Plate Photography" The contents of the third part are a little diversified, as will be seen. To return to Part I., it will be observed on glancing back at the foregoing fifteen chapters that its object is now virtually fulfilled. There are, however, some points of interest which have been as yet passed by These were, for the most part, represented by operations, the description of which, while affecting the continuity of the current work, could not with any honesty be stretched out to form even the short chapters into which, for the sake of speedy reference, our subject-matter has been advisedly divided. And so it has been resolved to group these items into an Appendix, not necessarily of great length, but sufficiently comprehensive as not to lose sight of any omission or rather postpone-

ment hitherto made in carrying out our plan of giving an exhaustive account of Practical Photography To introduce the various items of information no preface will be needed beyond the few words already written and the headings of the respective paragraphs

Interiors —Most beginners in photography are anxious to try their hand at interiors, and are not unfrequently disgusted to find their efforts unattended with success The truth is that the reproduction of interiors, as a rule, requires not only care but practice in that particular branch The beginner may profit by learning that the collodion used should be a sample which has been iodised some little time and has acquired a dark tinge of yellow When the plate has been transferred to the dark slide it should be backed with damp blotting paper, and allowed to drain upon a strip of the same material The chief point in photographing interiors is the exposure, which should by no means be hurried. Two or three hours are frequently necessary to produce an adequate representation of a shady room The light in an interior, too, is often troublesome A window through which the sun has been pouring during the exposure of the plate will come out a mass of blurred white This blurring or halation can sometimes be prevented by screening the window or source of light until the exposure is nearly completed

Copying —In copying by the wet process, as in photographing interiors, a ripe collodion should be employed An important feature in successful copying is the lens Portrait lenses stopped down, so as to render the margin of equally sharp definition with the centre of the picture, answer fairly well, but the finest copying lenses are the doublet symmetricals and rectilinears of Ross and Dallmeyer respectively. Single lenses should not be used systematically for copying, as they give highly distorted marginal lines, and so destroy effect. Copying should be carried on in bright light, and the lens should be pointed straight to the centre of the subject to be reproduced. Pictures behind glass should by reason of the reflecting surface of the latter be removed from their frames. For myself I greatly prefer taking copies and photographing interiors with dry plates prepared by any standard method, to employing wet collodion for these particular purposes.

Ferrotypes —Amongst the variations of the wet process, the taking of ferrotypes holds a conspicuous and not unpopular position. A ferrotype, as the name implies, is a picture upon a thin plate of iron, which takes the place of glass as a support for the collodion film. These plates can be procured of two qualities, "egg-shell" and "glossy," from (among others) J. Fallowfield, 36, Lower Marsh, Lambeth, S.E. That dealer also supplies ferrotype collodion (as approved by Mr Estabrooke, the

great American ferrotyper), ferrotype varnish, envelopes, mats, &c I give from his catalogue the formulæ for ferrotype pictures as used by American photographers

SENSITISING BATH

Recrystallised nitrate of silver	2oz
Distilled water	20oz

Mix, and then add 1dr of the ferro-collodion, shake and filter, and add two or three drops of nitric acid The bath should be nearly neutral. If the shadows are muddy, add a little more acid.

DEVELOPING SOLUTION

Protosulphate of iron	1oz
Water	20oz
Glacial acetic acid	1oz
Alcohol	1oz

Filter, and it is ready for use For fixing cyanide of potassium is preferred If in taking ferrotypes it be desired to avoid the yellow tinge, which that class of pictures are apt to exhibit, a course recommended is, after development, to flow the plate thoroughly with a strong solution of *gallic acid*, and to wash well again before fixation To take a medallion ferrotype, a sheet of white cardboard, with an oval opening in the centre, is placed upon an easel and interposed between the camera and sitter The background should be dark Pictures thus produced are especially suitable for embossing Vignettes are secured in the same manner, with the exception that the opening in the cardboard should be serrated (*i e*, toothed like a saw), and that the latter, during exposure, should be quite out of focus A neat way of preserving ferrotypes is to slip each picture into a specially designed "envelope" with dome or arch opening, and a flap to protect the portrait from injury

Albumenising Glasses.—Many good photographers make a practice before coating a plate with collodion of giving it a prior substratum with a solution of albumen This last is prepared according to the following formula:

ALBUMINISING SOLUTION

White of one egg.	
Water ...	20oz
Ammonia ..	6dr.

Beat up the white of egg (having separated the yolk) into a froth, and allow to settle for a few hours, add the water, shake well, and finally add the ammonia prescribed above. This solution after being kept a few days may be filtered and used forthwith While pouring it on to the plate care must be taken to avoid air bubbles on the film, and the solution must not be allowed to flow over the edges or the back of the

glass. If attention is not paid to this latter item, the superfluous albumen will contaminate the sensitising bath. After coating, the albumenised plates can be allowed to dry away from the dust and stored for future use. A more convenient method than pouring is to apply the albumen with what is known, from its inventor's name, as the Blanchard brush. This is made in the following manner. A strip of glass is procured about 6in. long, and 2in. broad, also a strip of swansdown calico the same width as the glass, but only 4in. long. The latter is folded in the middle and bound at its ends to one end of the strip of glass, leaving, as it were, a broad loop of the swansdown calico about 1in. long. This forms a wide brush (not unlike, except for its being formed of a fold, the brushes employed for damping copying tissue) to be dipped in the albumen solution, the excess of which should be squeezed out against the edges of the vessel in which it is contained. The surface of the plate can then be brushed up and down, and a smooth layer of albumen easily imparted to it. The glass plate should be chemically clean, and may be coated either in a dry state or, perhaps preferably—especially when pouring is resorted to—after being moistened with pure water. After pouring on like collodion, the surplus solution should be returned, not to the pouring but the stock bottle. This prevents both the accumulation of dust in the pouring bottle and the formation of air bubbles in subsequent coatings. The great advantages of albumenising plates are that it forms an effective cure for splitting and slipping films, and that it has the merit, when a plate has once been made clean, of keeping it so for many months. I may as well mention here that the white of egg in all photographic operations may be replaced by dried albumen, to be procured of most photographic chemists; 1oz. of that prepared by R. W. Thomas, of 10, Pall-mall, is equal to the whites of seven eggs. To make liquid albumen of the natural strength 70gr. of the dried substance are dissolved in 1oz. of water and strained through fine cambric.

Developers.—Besides the common developer, the formula for which was given in the latter part of Chap. II, there are various others, the employment of which is attended with successful results. The double sulphate of iron and ammonia is noticeable for its power of keeping without deterioration. A standard formula for a stock solution is as follows:

AMMONIO-SULPHATE OF IRON DEVELOPER.

Ammonio-sulphate of iron	1½oz.
Glacial acetic acid	1oz.
Spirits of wine	½oz.
Water	20oz.

It is sometimes satisfactory to add organic substances, such as sugar

or gelatine to the developing solutions, in order to procure additional density Here are two formulæ for

ORGANIFIED DEVELOPERS.

(1) *Saccharō-sulphate of Iron.*

Protosulphate of iron	3dr
Lump sugar ..	1dr.
Glacial acetic acid	1dr.
Spirits of wine .	1dr
Water	8oz

(2) *Gelatine Sulphate of Iron.*

Protosulphate of iron ..	3dr.
Glacial acetic acid	1½dr.
Gelatine ..	8gr
Spirits of wine ..	1dr
Water ..	8oz.

The presence of organic substances, such as the above, acts as a restrainer and keeps away fog If gelatine be used, the exposure should be slightly longer than usual Talking of restrainers, the well-known *Collocine* of Mr. Carey Lea must not by any means be passed over. This preparation possesses great restraining power and the additional valuable property of reducing the exposure to a considerable extent It is prepared commercially by Wratten and Wainwright, of 36, Great Queen-street, W.C., at the rate of 2oz for 1s Only a drop or two need be used at a time.

Intensifiers —Instead of "acid pyro," in combination with a solution of nitrate of silver solution, the following formula, recommended by Mr Valentine Blanchard, has been adopted by many photographers

IRON INTENSIFIER.

Protosulphate of iron	1dr
Citric acid	2dr
Water .	10oz

This, of course, must be mixed, like "acid pyro," with a solution of silver nitrate The same strength of the latter is applicable to both pyro and iron. A prominent feature in this intensifier are its keeping qualities. It works better after the lapse of a month or two than when freshly prepared.

Stereoscopic Pictures.—A stereoscopic picture is a representation of an object from two slightly different points of view. There are few to whom the drawing room stereoscope with its accompaniment of photographic pictures is not familiar; but it must be said at the same time that about these scientific toys, as folks are wont to call them, there is existing a great amount of needless miscomprehension. To begin with, let us take one of these stereoscopic pictures and examine it. We shall

find, as I said before, that it is a representation of some scene or object from two slightly different points of view. We put the slide, as a mounted stereo is sometimes called, into the stereoscope, and a curious metamorphosis in its appearance at once takes place Instead of two pictures we see but one, and that one is distinguished by a marvellous fulness and relief which strikingly represents the manner in which we view natural objects with our own eyes It is not my intention to go further into the scientific principles on which the effects of stereoscopicity are based, as there are various scientific works in which the subject is discussed far more fully and more satisfactorily than I could hope to discuss it in a manual of practical instruction. But as stereoscopic pictures undoubtedly constitute an important branch of photography, it will be necessary to give an account of the very simple ways and means connected with their production In the first place, it is obvious that, to avoid inconvenience, if not pseudo-scopicity, the two pictures comprising the stereogram should be taken almost, if not quite, simultaneously This result can be achieved in either one of two ways The first is to employ a camera mounted upon a lath or bar of wood, upon which it slides from right to left. The bar or lath is screwed on to the tripod, and the camera stationed at the right end. A picture is now taken with the apparatus in its present position, after which the camera is slid to the other end of the lath, and the other component of the stereogram secured. In mounting the prints from the negatives obtained in this apparatus great care should be taken to preserve the proper position of the two pictures. If they are taken from two separate negatives it is necessary to *transpose* the latter, then to cement the two corresponding sides together, and finally to bind them by a strip of paper round the edges to a single plate of glass of a size equal to that of the two negatives If cut out masks, preferably of dome or cushion shape, are accurately pasted on to the two negatives so as to allow of no interstice through which the light may penetrate to the sensitised paper, the stereogram can be secured at a single printing. Another plan in working with a lath stereoscopic camera is to have a dark slide capable of taking the whole stereogram on one plate and arranged so as to bring successively both halves of the latter behind the lens. This is adjusted so as to obviate the necessity of transposition and subsequent cementing and binding to another plate. The great defect of the lath camera is its inability to secure negatives of moving objects, which are peculiarly fitted for subsequent scrutiny with the help of the stereoscope. Thus, for general use, it is recommended to produce stereos with what is called a twin lens or binocular camera. This instrument, as its name implies, has two lenses fixed on its front, by which the two pictures are taken

simultaneously. In Chapter IX I recommended my readers to procure such a camera for general use, as by removing the partition employed in taking a stereogram, in order to prevent the light from one lens affecting the half of the plate on which that from the other is intended to act, the camera can be used for taking single pictures on the full size of the plate. In working stereos with a binocular camera the two pictures must be transposed on the mounting card—that is, the print from the stereographic negative must be cut in half, and the original right-hand picture pasted on the left hand of the card Another course to adopt is to cut the negative in half and transpose the halves, as in working with two separate negatives in the lath camera With regard to the lenses specially applicable to stereoscopic photography, I may mention Dallmeyer's "New Stereoscopic," "Patent Stereographic," and "Quick-acting Stereoscopic" lenses, together with Ross's "Instantaneous Stereographic," as exhibiting the highest possible type of excellence in this peculiar branch. All these lenses are applicable to portraiture, and can be used for simple landscapes of half-plate size by unscrewing and dispensing with the back, and then replacing it by the front combination A pair of rapid rectilinears or symmetricals also answer admirably for stereoscopic work. It may be added in connection with stereoscopic photography, that an even finer effect than that exhibited by the ordinary paper "slides" is to be obtained by producing the stereogram in the form of a transparency, instructions for preparing which will be found further on

The Dark Room Window.—The question of a convenient and at the same time effective means of providing a non-actinic light for the dark room is one so important to the beginner, and, for the matter of that, to the proficient, that perhaps a few words beyond those already given in the body of this work will be acceptable. Of late, two preparations connected with non-actinic light have been started, both of which promise to be widely popular The first is in the form of a varnish called *Chrysoïdine*, which is said to be used with great success in cutting off the actinic rays. The second is a species of muslin, prepared, I believe, with this very varnish, or with a dye containing an identical colouring matter The chrysoidine varnish can be obtained from, amongst others, Messrs Mawson and Swan, Newcastle-upon-Tyne. The non-actinic muslin is manufactured and sold by J Solomon, of 22, Red Lion-square. The colour of the latter is a most beautiful orange, and two thicknesses of it are sufficient to cut off the effects of the most powerful actinic light from the most sensitive plate. A few feet of this material hastily tacked round the sash of a window of moderate size at once converts even a bed chamber into a dark room, quite impenetrable

by a direct sunlight The muslin is rather expensive, being 7s. per yard of 32in width, but when its utility is considered, the price can hardly be cried out against A third method of non actinically lighting the dark room I clip from a letter to the *Photographic News* in which this recipe is given —"Get the following tubes of oil colours from an artists' colourman burnt sienna, raw sienna, megilp. Mix the three together in equal proportions with a palette knife, and with a soft hog's hair brush paint both sides of the window When dry a second coat may be given on the outside if needed Chrome yellow is useless, for not only is it too granular and opaque, but it has a tendency to bleach A window 3ft or 4ft square can be painted for 2s, the tubes costing 4d each For dark tents a single piece of yellow cloth painted on one or both sides makes a capital window" The author of the above recipe has used a window prepared according to it for ten years, and states that in the light produced by it, even though the window be a yard square, the most sensitive plate can be developed without fear of fogging As a basis for the non-actinic pigment no coloured or flashed glass is needed, ordinary sheet glass, such as is commonly used for window panes, being sufficient For those who are not fortunate enough to secure a dark room with a window, and who are thus precluded from turning the daylight to account, it will be necessary to employ a lamp or candle with some kind of non-actinic shade Various methods of manufacturing such shades will readily suggest themselves to the ingenious student, but I will briefly notice two which are not within the limits of home resources The first of those is the candle reflector, which is constructed for adjustment on a candle, and which reflects the flame very strongly on to any desired spot. A piece of orange paper or cloth tied over the open face of the reflector at once gives a most satisfactory light, than which hardly anything better can be desired Other ingenious contrivances have been lately introduced in the shape of globes and chimneys for lamps or gas of ruby glass The utility of these is too obvious to need explanation

Stains from Photographic Chemicals—There are several methods of obviating or removing the highly unpleasant stains arising from the employment of certain of the chemicals used in photography One method, following the rule, that "prevention is better than cure," is to sheath the hands in gloves of soft indiarubber, which can be procured at the various establishments devoted to the manufacture of that material There are also several courses which can be adopted for removing the stains which have actually appeared. Cyanide of potassium is effective, but too dangerous for general use The following is an excellent and harmless recipe —"Put ½lb. glauber salts, ¼lb chloride of lime (the

sanitary disinfectant), and 8oz of water into a small wide-mouthed bottle, and when required for use pour some of the thick sediment into a saucer, and rub it well over the hands with pumice-stone or a nail brush, and it will clean the hands quite equal to cyanide, but without any danger This will do to use over again until exhausted, and should be kept corked up" The disagreeable smell arising from the use of this mixture may, it is said, be entirely avoided by the liberal application of lemon juice, which not only removes the smell, but whitens the hands F S. Cleaver, the well-known soap manufacturer, makes a "photographic soap," specially prepared for the removal of photographic stains

Photographic Varnish Making —Although amateur varnish making is by no means to be recommended as a general thing, there are occasions when the ability to perform it are decidedly convenient For this reason I give the following recipe by Mr Nelson Cherrill, a well-known and practical photographer, for making up a simple and good varnish, in quantity sufficient to last an amateur many a long year There is no object whatever in preparing varnish in small quantities Mr Cherrill's own words are as follow "Take three-quarters of a pound of gum sandarach and 2oz of gum shellac (the brown I used), and place them in a bottle, and cover them with very strong alcohol Stir up frequently, and keep in a warm place, in about two days pour off the liquor into a Winchester bottle, and put again some more strong alcohol, let it digest two or three days longer, stirring often, and keeping the bottle in a warm place This will dissolve all the residue Add the liquor to that already in the Winchester, pour in an ounce of castor oil, and shake it well up Now dilute the whole with common methylated spirit till the Winchester is full, and, after fining, which will happen in a week by itself, you will have as good a sample of varnish as anyone need want. The point in this preparation is that the pure alcohol, being used as a solvent, only seems to take up all the good properties of the gums, and, when the dilution comes, all the gum is still held in solution, whereas, in my hands at least, any attempt to dissolve the gums direct in the methylated spirit is a failure, as far as the quality of the varnish is concerned. This varnish will dry half bright, and will take the pencil very readily, if it be wanted to add to the tooth The surface will rub with perfect ease by the finger being just touched with powdered pumice or resin," &c

With the above few hints I conclude the first part of "Practical Photography."



PART II.

DRY-PLATE PHOTOGRAPHY.

CHAPTER I

INTRODUCTORY—NECESSARY APPARATUS—PREPARING A PLATE—SENSITISING—DRYING—BACKING—EXPOSURE—DEVELOPING—INTENSIFYING

IN commencing an account of a subject possessing so many individual and general aspects of both scientific and practical interest as dry-plate photography, some slight introduction will be really needful The universal practice of dry-plate photography involves an acquaintance with a certain number of processes, all more or less connected with certain fixed scientific principles That the tendency of these principles, as well as the results of their practical application, may be generally understood, it will be necessary, as stated above, to preface any detailed account of the various dry-plate processes with some sort of comprehensive introduction

To begin with, for the benefit of those to whom the first part of this work is unknown, a slight recapitulation must be made of a few remarks which have already been thrown out relative to the nature and functions of dry-plate photography As its name very clearly implies, a "dry-plate" is a plate coated with a dessicated or dried sensitive film The use of this dry film will be readily understood by those to whom the practice of wet collodion is familiar, the great drawback to this latter process being that unless the photographer carries his dark room, apparatus and all, like a snail, upon his back, he is unable to practise his art upon objects more than a mile or two distant from home It is here that dry-plate photography comes to the rescue by providing a means whereby even the most portable dark tent is dispensed with Indeed to such perfection has this branch been brought that a dry plate which has taken

perhaps but a few minutes to prepare may be kept for years before exposure, and as long between exposure and development The immense advantages which such qualities as these confer need not be descanted upon.

And now for an outline of the various processes by which the preparation of dry plates is accomplished These processes may be ranged under two heads, "Bath-plate" and "Emulsion" By the first a plate is sensitised in the ordinary dipping bath such as is used in wet collodion, then washed to free it from the *nitrate* of silver, and finally flowed over with some sort of *preservative*, the use of which will be fully and separately discussed hereafter The plate is then allowed to dry, and may be exposed at the convenience of the operator By the Emulsion processes, a preparation is made in which the sensitive salts are held in suspension, and which is poured on to the plate like collodion The film, as in the Bath-plate process, is left to dry, and may in many cases, as before stated, be stored away for an indefinite period without losing its sensitive properties

Both Emulsion and other ready-prepared dry plates can be easily procured of photographic dealers, many of whom make this branch of commerce a specialty It is even a possible, and, indeed, a not unfrequent resource for amateurs who have more money than industry, to send their exposed plates to be developed, and subsequently printed from, by professionals, thus reducing their own share in the production of a photograph to the mere uncapping and recapping of the lens For such as indulge in this practice, the present instructions are in no way written It is all very well from want of time or other reasons to buy ready-prepared plates, indeed, in some cases it is absolutely a saving, not only of time, but of money to do so, but to send one's exposed plates away to be developed, an operation which, by the way, is one of the most prominent and important in the whole practice of photography, is simply a fair avowal of utter helplessness on the part of any *soi-disant* operator. It is to be hoped that the present series will inculcate very different principles from these, by laying down a straightforward course of instruction, which shall have reference, not only to results, but to causes as well. To carry out this intention, the various processes will be discussed separately, and the utmost care will be taken to prevent failure arising from ignorance even of the minutest point of detail.

Without going further into this question at present, let us imagine that we have before us a stock of dry plates, either prepared with the aid of the bath or coated with an emulsion, of home or shop manufacture, it does not matter which. Here are the plates, the question is what to do with them In the first place, it will be necessary to find some convenient means of storing them away from the light and the damp. To this end

plate boxes may be used, but not those of the ordinary kind employed for storing negatives, as the rough grooves would tear the edges of the dry but often tender film. Hence, in plate boxes for dry plates, the grooves should be V shaped and cleanly cut. The addition to the price is insignificant. Again, if the plates are to be stored away for any length of time, the plate box should be of some hard close-grained wood, such as mahogany or walnut, or, if of deal, should be lined with tinfoil, to prevent the exudation of moisture given out by that kind of "stuff." The plates should also be inserted with the films of every couple opposite to another, so that no one plate may absorb any incidental moisture which may be existing on the back of its neighbour.

When the time for exposure comes another slight modification of the apparatus requisite in the Wet Collodion process will be necessary. Of course the plates may be taken out singly and exposed in the ordinary dark slide, or in a number of ordinary dark slides, but this would either limit the operator to one negative or add considerably to his encumbrances. To avoid both of these drawbacks, either one or two courses are open to the dry plate photographer. One is to employ *double* dark slides, which, as their name implies, are capable of holding two plates at once. These are provided with two shutters, one for each plate, so that when one plate has been exposed all that is necessary is to take out the slide and reverse it for another picture. The better class of double dark slides are hinged at the bottom, so as to open out as it were into two separate halves. Into each of these a dry plate is dropped with the fingers, or with the aid of a pneumatic plate-holder, and the slide, after a central partition with a spring on both sides to keep both plates in position has been adjusted, is closed up and fastened by means of hooks. The price of one of these double slides or backs for a half plate or 7in. by 5in. camera is about 18s., but the price varies according to the dealer from whom it is procured. I think I am right in saying that the quotation made by J. J. Shew, of 28, Wardour-street, Oxford-street, of 15s. 9d. for a hinged double back, is the lowest at present in the market. Solomon, of 22, Red Lion-square, Holborn, sells a cheap double back in which the hinge is dispensed with, both in the frame of the slide and in the shutters, at the following low prices: quarter plate, 8s.; 5in. by 4in., 9s.; half plate, 11s.; and whole plate, 12s. This back is advertised as the "Universal."

The number of double backs to be procured entirely depends upon the amount of daily work performed by the operator. Three backs to contain six plates will be found quite sufficient for all ordinary occasions, as well as forming a perfectly portable burden. This number may easily be carried in a leather case, a strap attached to which can pass after the

fashion of that of a courier bag, round the shoulder of the travelling photographer

In the place of double backs it is preferred by some to employ a *changing-box,* the best form of which is that manufactured and patented by G Hare, 26, Calthorpe-street, London In manipulating plates in a changing-box, it is necessary to have a special form of dark slide into which, by inverting the box the plates slide as required These changing-boxes are usually made to hold one dozen plates, and in certain cases as, for instance, when it is required to take a large number of negatives in one day, are even preferable in point of portability to double backs Mr Hare's Automatic Changing-box is distinguished not only by the facility with which it can be worked, but also by the fine finish of workmanship which it, in common with other productions of the same maker, exhibits The prices are as follow changing box and special dark slide for plates up to 5in by 4in, £3 15s, 7½in by 4½in £4 4s, whole plate, £5

The camera used for the wet process is applicable, if of sufficient portability, to dry plates as well To those desiring to purchase a fairly portable camera at a low price, I may mention the "folding" pattern, manufactured by J Fallowfield, 36, Lower Marsh, Lambeth, S E This is a most reliable instrument, and is equally adapted for use in the studio or the field It is suitable for lenses of both long and short focus, and when set is of great rigidity There are no loose screws (a great advantage in outdoor work), and, by an ingenious arrangement, the focussing can be accomplished with great accuracy without the help of a winch screw, or rackwork adjustment The price for a square half plate camera is £2 5s

While on the subject of cameras in connection with dry plate photography, it would be a pity to omit mention of the ingenious and pretty little pocket cameras now sold by so many dealers These tiny instruments are made to take in the smallest possible spaces plates 3in by 3in, 4¼in by 3¼in, and 5in by 4in They are almost exact models of the larger folding cameras, but their workmanship has necessarily to be of an excessively delicate and accurate nature They are mostly fitted with rackwork focussing adjustment, and sold with three little double dark slides for about £4 15s This price is for a pocket camera and slides of very superior workmanship, but Shew, of Wardour-street, sells one which is perfectly workable and convenient in every respect, with rackwork adjustment, for £2 17s, and without it for £2 2s Handy portable tripods are sold by different makers to accompany their respective cameras, amongst which the "Alpenstock" and "Umbrella" forms deserve notice

These little dry-plate cameras are really worthy of serious notice even

from the most ambitious photographer, as from the negatives taken in them either transparencies may be produced for the magic lantern, or enlargements up to almost incredible dimensions, losing but little in comparison with photographs taken direct The method of producing both transparencies and enlargements will be fully discussed in a future chapter

To sum up the above remarks upon apparatus, it may be said that every necessary in this line for the practice of dry-plate photography (excepting, of course, such incidental apparatus as may be required for preparing the dry plates themselves, of which mention will be made under the heads of the respective processes) is comprised by the following list A good lens, portable camera and tripod, and three double backs or a changing-box To these may be added as accessories, a plate box with V-shaped grooves, a pneumatic plate-holder, and a broad camel's hair brush to dust the plates before transferring them from the plate box to the slide or changing box

And now let us turn our attention to the differences, in a chemical point of view, between wet and dry processes of photography

Perhaps the best way to thoroughly familiarise the intending dry-plate photographer with the nature of the chemical preparations which he will be called on to employ, will be to enlarge the outline given at the commencement of this chapter, so that each stage in the production of a dry-plate negative may be separately considered and explained To begin with, let the reader imagine that he has before him a plain glass plate, to which he wishes to apply, either by a bath plate or emulsion process, a film for exposure in a desiccated state In the first place, it will be necessary to furnish the bare glass plate with a substratum or edging which will cause the future film to adhere tenaciously to it Unless this is done, it will be found that the film during development is liable to slip off the plate, as it does in the wet process when the collodionised plate is immersed in the bath before the collodion is duly set For a substratum the same formula may be used as that given in Chap XVI, p. 92, under the head of "Albumenising Glasses," namely —

SUBSTRATUM (1)

White of one egg	
Water .. .	20oz
Ammonia	6dr

This may be applied as before directed, either by pouring the solution over the plate or by the aid of the Blanchard brush Another substratum which may be applied in the same manner, is a solution of gelatine, as follows

SUBSTRATUM (2)

Gelatine	40gr
Water	30oz.
Ammonia	1dr

The formula for an edging, which many prefer to a substratum, is

EDGING

Indiarubber	5gr
Chloroform or Benzole	1oz.

This is applied with a brush which is charged with the solution, and run round the edges of the surface of the plate to the depth of about ¼in The chloroform or benzole, whichever it may be, that is employed as a solvent of the indiarubber, evaporates almost instantaneously, leaving a viscid edging, which effectually prevents slipping films It is obvious that care must be taken to keep the stock bottle of the solution tightly corked up, except when in use, to prevent unnecessary loss by evaporation If the quantity of the solvent in the above solution be multiplied five times, that is to say, five grains of indiarubber to five ounces of either chloroform or benzole, it may be poured over the cleaned glass plate like collodion to form a very useful substratum

A curious method of preventing slipping films, which is applicable to some of the emulsion processes where the plate is not subjected to immersion, is, the use of steotite, or French chalk A little of this substance is sprinkled over the plate and lightly rubbed till it has touched every part of the surface of the latter The plate is then rubbed finally with a chamois leather until every trace of the French chalk is removed Although this may seem a strange proceeding, it is, nevertheless, wonderfully efficacious, as the operator will find out by experiment

Having applied a substratum or edging to the plate, the next step is to sensitise it Assuming that a bath-plate process is being practised, the plate is now collodionised and immersed in the dipping bath A collodion which gives thoroughly good results in the wet process may ordinarily be used, and the bath solution may be of the usual strength In cases where this rule may be departed from with advantage, due notice will be given of the fact under the heading of the respective processes

After the sensitised plate has remained in the bath for some minutes it is withdrawn and carefully washed in order to remove all the free nitrate from the film To accomplish this, the plate is first transferred to a dish filled with distilled water. The covering of the surface of the film should take place without stoppage, otherwise markings, as in the case of a stoppage while transferring the collodionised plate to the sensitising bath, will result. When the greasy appearance due to the

repellent action of the ether and alcohol in the film towards the water in which the latter is immersed has disappeared, the plate may be removed from the dish of distilled water and washed for from one to three minutes under the tap The washing is completed by a final rinse with distilled water

At this stage, if a preservative is to be employed, it should be applied to the plate The latter is drained, and the former may either be flowed over it or administered in certain cases, as will be seen, in a dish Amongst preservatives in common use may be mentioned tea, coffee, albumen, gum, and many other substances It will be well to quote here what Captain Abney, to whom both the science and literature of photography are perhaps more greatly indebted than to anyone living, says concerning the ends to be obtained by the use of a preservative, in his "Treatise on Photography" This work has been published by Messrs Longmans in the Text Books of Science series, at the price of 3s 6d, and, as a most comprehensive, lucid, and trustworthy manual of scientific reference, ought to take a prominent place on every photographer's shelves As Captain Abney's important remarks on preservatives are too concise to admit of abbreviation, and too good altogether to allow of any portion being lost, the liberty is taken of extracting them in full. "A preservative," he observes, "must be (1) an iodine or bromine absorbent, for, without this quality, the film manifestly might be insensitive (2) It must be capable of filling up the minute pores of the collodion, so that on re-wetting after drying it may give access to the developing solution (3) It must act as a protective varnish against the atmospheric influences Regarding the first point there is not much difficulty, as nearly every organic animal or vegetable compound is capable of combining with iodine Under the head of absorbents we may rank tannin, pyrogallol, gallic acid, gums, gelatine, albumen, caffeine, theine, and other like bodies The second requirement may be met by the employment of some of the above, or by the addition to them of sugar in various forms The last requirement is more difficult to meet, and is very often neglected, as it entails that the body should not be hygroscopic. The drawback to any processes, for instance, in which the preservatives contain gum arabic, is that moisture is attracted, and the sensitiveness of various parts of the plates is affected No better varnish is known than albumen, though this has its disadvantages as regards rapidity, unless the greater portion of it be removed previous to desiccation, or unless it itself becomes a vehicle for holding the sensitive salts, as in the collodio-albumen process." In Captain Abney's opinion an unexceptionable preservative has yet to be found. He thinks it doubtful whether it will not be found advantageous to dispense with it altogether, when the balance between the pyroxyline

(gun-cotton) of the collodion and the sensitive salts is properly adjusted, as in the case of certain emulsions "It must then be borne in mind," he concludes, "that the word 'preservative' is only employed for want of a better"

In working with emulsions, the course of operations is essentially different from that adopted in the various bath plate processes The discrepancy consists, as before stated, in the substitution for the collodionising and subsequent immersion in the bath, usually of a sensitive collodion, that is to say, one which holds the sensitive salts in suspension, and which is poured direct upon the plate after the latter has received a preliminary substratum or edging By some it is preferred to enclose the sensitive salts, not in the pyroxyline of a collodion, but in gelatine This point will be fully discussed, together with various others connected with emulsions, when the bath-plate processes have been treated of In some cases plates prepared by emulsion processes require washing, and the subsequent application of a preservative, but these points will also profit by receiving individual notice when necessary

In any case, whether a preservative be used or not, the plate will, of course, in order to carry out its name, have to be allowed to dry This it may generally be suffered to do spontaneously away from the dust For gelatine plates a special kind of drying box is necessary, the construction of which will receive due explanation For ordinary dry plates a zinc plate box, with V shaped grooves, which may be set on a stove with its lid slightly ajar in order to allow the moisture of the films to escape, will often be found useful A strip of blotting paper should be laid at the bottom of the box, and the plates should be inserted with their films face to face. Messrs Wratten and Wainwright, of 38, Great Queen-street, sell drying boxes, which will be found very useful by those who are in the habit of preparing dry plates in the day time, and who have not two doors to their dark room Mr Woodbury advises emulsion plates to be dried in the following manner On a small iron tripod he adjusts a piece of sheet iron, and introduces beneath it a spirit lamp or Bunsen burner On the sheet of iron a few thicknesses of blotting paper are laid, and on these again the plate to be dried By this means the latter is desiccated with great readiness and uniformity

Some dry plates are liable to a fault, at times very inconvenient, which is known by the name of "blurring," and which is the result of necessarily long exposures To obviate this, it is frequently needful to furnish the plate with a non-actinic backing, which has the effect of preventing the appearance of blurring or irradiation as it may, perhaps, more rightly be called. There are various ways of applying this backing. Some use a non-actinic pigment, applying it with a brush, others prefer the handier

method of applying to the back of the plate a gummed piece of non-actinic paper The expedient is sometimes resorted to of staining the emulsion with non actinic dye, such as aurine, but this has the effect of materially diminishing the sensitiveness of the plate

The exposure necessary for dry plates is very varied indeed In some cases when using bath plates, an exposure of ten or even twenty times that suitable for a wet plate is not too much, while in others, as for instance in the cases of instantaneous gelatine plates, vigorous negatives can often be secured in a fraction of a second Some hints as to exposure will accompany the account of each process Attention must now be paid to the methods of development applicable to dry-plate photography

There are three distinct methods of developing dry plates The first of these is to employ a developer varying but slightly from that used in the ordinary wet collodion process, the chief components of which are sulphate of iron and glacial acetic acid This iron developer is only applicable to dry plates, when the latter are produced with the aid of the bath, and even then is frequently disadvantageous in cases where the plates have been kept some time since exposure The process in which it produces under favourable circumstances the best results, is the gum gallic of Mr Manners-Gordon, under the head of which a formula for an iron developer will be duly given

But by far the most important as well as most successful means of producing from a desiccated film the latent image, is by what is known as *Alkaline development* This can be adapted to dry plates, produced by either bath or emulsion processes, in every case where the film contains even the smallest amount of bromide of silver As this last qualification exists without exception in every one of the real "dry" plate processes, the use of the alkaline method of development is very extended indeed, and, as will be seen, possesses peculiar advantages as regards latitude of exposure, and so forth Alkaline development is based upon the employment notably of alkaline pyrogallates formed of pyrogallic acid, the developing power of which has been greatly accelerated by the addition of an alkali, such as ammonia In practice it is found that in a developer of this kind it is needful to employ a restraining power in order to prevent the unduly rapid action of the alkaline pyrogallol, and consequent fogging of the plate The restrainer employed is *bromide of potassium*, which, for convenience, is kept and subsequently added to the alkaline pyrogallol in an aqueous solution of varying strength

To develop a dry plate by alkaline development there are several formulæ, any of which can be adopted often at the will of the operator. But, before actually proceeding to the development of the latent image,

there are usually one or two necessary operations to be performed, such as removing the backing and washing off the preservative, if either have been previously applied If the backing has been merely painted on with a brush, it can be easily removed with the aid of a sponge If a strip of non-actinic paper has been used, the back of it is damped, and it peels off without difficulty If the photographer is in the habit of using plates subject to halation, he will find a vice a very useful addition to his dark room If this is screwed out to the proper width, and the plate laid face downwards with a little care upon the rebates, the backing can be applied and removed with the utmost facility Supposing that, in lieu of backing on the plate, an emulsion has been stained with aurine or any other dye, it will probably be found necessary to flood the plate with a solution of methylated spirit in water previous to development This solution of spirit is also useful in many cases to remove such preservatives as are soluble in alcohol, and to open up the pores of the collodion in such a manner as to allow free-access to the developer Occasionally the preliminary wash of spirit and water may be replaced by one of water alone, in any case the matter will receive special mention in connection with each of the various processes

When the backing (if any) has been removed, and while the plate is still damp from the wash of dilute spirit or water, which should be drained off as much as possible, the developer is poured on Although they will probably have to be repeated hereafter, two standard formulæ for alkaline developers are here given in outline in order to familiarise the beginner with the principles on which they are based, and in some degree to give him timely warning of the nature of one of the principal preparations which he will be called upon to make up and employ The first is as follows

ALKALINE DEVELOPER.

No 1 —Pyrogallic acid		12gr
	Water	1oz
No 2 —Liquor ammonia		1oz
	Water	4oz
No. 3 —Citric acid		60gr
	Acetic acid	30min
	Water	1oz.
No. 4 —Nitrate of silver		20gr
	Distilled water	1oz.

Details as to proportions and mixing will be given elsewhere This developer is peculiarly adapted to plates containing gelatine or albumen. Another developer, even more typical of the principles of alkaline development than the one already given, is that the bare formula of which is given below. It is known as the "Strong Alkaline Developer" of Colonel Stuart Wortley, by whom it was introduced. Colonel Stuart Wortley is

a distinguished photographic amateur, and is well known for his excellent rapid Uranium process, which will be commented upon and explained in the course of the present work The strong alkaline developer, as it name implies, is of great power, and images are produced by its aid with the minimum of exposure in the camera Here is the formula

STRONG ALKALINE DEVELOPER.

No 1 —Carbonate of ammonia		80gr
Water		1oz
	(or)	
Liquor ammonia		1oz
Water		16oz.
No 2 —Bromide of potassium		12gr
Water		1oz
No 3 —Pyrogallic acid		96gr
Alcohol		1oz

Of this four parts of No 1 are mixed with two parts (in cold weather one part) of No 2, and one part of No 3, the mixture is flowed at once over the plate, and the image, if the exposure has been correct, and other conditions fulfilled, will almost immediately start out It must be carefully kept in mind that in this and other alkaline developers, as above stated, the pyrogallic acid is the real developing agent, the ammonia is the accelerator, and the bromide of potassium the restrainer These facts are of peculiar importance, and a due recognition of them will enable the photographer to draw from his knowledge several very useful conclusions Suppose, for instance, he is about to develop a plate, which, by accident or otherwise, has received an over long exposure, by reducing the ammonia or adding more bromide he weakens the power of the developer, and produces perhaps a negative which can hardly be distinguished from one to which exactly correct exposure has been given On the other hand, if it transpires even in the course of development itself, that the exposure has not been of sufficient duration, the obvious remedy is to bring up the image by the addition of more of the accelerating ammonia. It must be borne in mind, however, that although by experience and skill the alkaline developer can often be so manipulated as to counterbalance in a great degree the effects of faulty exposure, it can never do so completely

There is nothing to compare in evenness and truth of gradation of tone with a plate produced by any process to which correct exposure has been given. Failing this, it will be found that of the two evils of under and over-exposure the latter is the lesser, and that while from an over-exposed plate, with care and skill, an almost perfect image can often be developed, an under-exposed plate is generally, from its weakness and absence of

contrast, fairly useless Another "wrinkle" may be borne in mind in connection with the reproduction, by dry plate photography, of objects where the lights and shades exhibit very strong contrast indeed, and result, ordinarily speaking, in an inharmonious and apparently under-exposed picture In such cases as this it has been advised to lessen as much as possible the quantity of pyrogallic acid in the developing solution This can be done either by keeping a separate solution of pyro, of a strength half as weak as that mentioned in the formula, or by adding water to the mixed developer before applying the latter to the plate

It will often be found advantageous, especially to the fingers of the operator, to apply the developer in a dish of a little greater length and breadth than the plate The dish should be preferably of glass or ebonite, and can be purchased of almost any photographic dealer In using it, care must be taken to apply the developing solution, especially if the plates be rapid and fully exposed and the developer strong, in an even sweep, as otherwise the development will be unequal, and unpleasantly pronounced markings will result

Although with the alkaline system of development it is perfectly possible to obtain full printing density by merely adding a little of the ammonia solution without any restraining bromide to the developer already in the measure, and re-applying the latter with the added accelerating power, still this course is not to be recommended It is far better in every case to wash off the alkaline pyrogallol as soon as the detail of the picture is completely out The plate should then be allowed to dry, after drying be remoistened under the tap or from a jug, and finally treated with the ordinary acid pyro intensifier, as used in the wet collodion process, for which the formula is

ACID PYRO INTENSIFIER

No 1 —Pyrogallic acid	3gr
Citric acid	2gr
Water	1oz
No 2 —Nitrate of silver	20gr
Distilled water	2oz

This is applied in the usual manner by flowing No 1 over the plate once or twice to allow it to combine with the water with which the film has been moistened, and after draining it back into the measure, adding a few drops of No 2 and re-applying to the plate. If the plate is not allowed to dry, as directed, between the washing off of the developer and the application of the intensifier, it should be flooded with a 1 per cent solution of acetic acid in water By intensifying with acid pyro and silver it is noticeable that the negatives produced

by dry processes acquire much of the character of those produced on wet plates

I now come to the third system of development in dry plate photography, which is the fruit of a late discovery, and due, so far as its popular introduction is concerned, to Mr W Willis, jun The chief component in this system of development is *ferrous oxalate*, which is mixed in the following manner 4oz of neutral oxalate of potash are dissolved in 16oz of water, when dissolved, about 1oz of ferrous oxalate is added The formula therefore runs thus

FERROUS OXALATE DEVELOPER

Neutral oxalate of potash	4oz
Water	16oz
Ferrous oxalate	*about* 1oz

The ferrous oxalate developer is administered in a dish, or preferably in a dipping bath The plate is moved slowly up and down during development, which may take from five to ten minutes, and even a quarter of an hour to perform If the resulting image is weak, it is probably owing to the fact that the developer, from exposure, has become inert A pinch or two of the ferrous oxalate will quickly restore its vigour To keep the ferrous oxalate solution for any length of time, it is necessary to keep a skein of bright iron wire in the bottle or a slight excess of ferrous oxalate in powder beyond that which the solution takes up The great beauty of this developer is the absolute cleanliness with which it can be manipulated and the simplicity of its operation It is especially applicable to transparencies, as it produces a picture which requires no further toning The price of ferrous oxalate is 6d per oz, of neutral potassium oxalate 4d per oz Messrs Mawson and Swan, Newcastle-on-Tyne, sell the solution ready made up in pint bottles for 1s 6d, four pints, 5s This is a cheaper method of purchase for the amateur than to buy the ferrous oxalate and potassium oxalate in powder Messrs Mawson and Swan are enabled to sell the solution at low rates, from the fact that they do not have to reduce the ferrous oxalate to a dry powder and again dissolve it, but make up the solution direct

Captain Abney recommends the addition of a few grains of bromide to the developer immediately before use, this restrains all tendency to fog, and produces brilliant pictures

The operations of fixing, varnishing, &c, in dry plate photography are identical with those requisite in the wet collodion process, and so will not need recapitulatory comment I will turn, then, without more delay to the discussion of the various processes by which negatives may be obtained from desiccated films.

CHAPTER II

BATH-PLATE PROCESSES—WASHED PLATE—COFFEE—ALBUMEN AND BEER—COLLODIO-ALBUMEN—TANNIN—GUM-GALLIC.

The Washed-plate Process —This is *par excellence* the simplest of all dry processes in vogue Its introduction is due to Mr Jabez Hughes, an eminent photographer, known alike for his professional skill and for his capital little work entitled, "The Principles and Practice of Photography Familiarly Explained" The washed-plate process is as follows A plate is collodionised and sensitised in an ordinary negative bath, exactly as for the wet collodion process The sensitised plate, however, instead of being transferred immediately to the dark slide, is well washed with distilled water from a bottle or jug This operation removes all the superficial silver nitrate solution in the film The washed plate can now be reared up to dry in a dark place away from dust When the film is desiccated the plate may be transferred to the dark slide and exposed for half as long again, or even twice as long, as an ordinary wet plate under similar circumstances Prior to development, which should take place as soon as possible after exposure, the plate must be immersed for a second time in the sensitising bath On its withdrawal it may be treated with the ordinary developing solution of sulphate of iron and acid The whole process is laudably simple, and by its means, provided the collodion and bath are in good order, creditable negatives can be obtained with ease and a fair degree of certainty It has one drawback—namely, that the dried plates will not keep for any length of time without deterioration To insure success, the plates should be prepared overnight, exposed the next day, and developed as recommended above, within a few hours of exposure Washed plates are useful when it is required to reproduce objects within walking or driving distance from home, but they are disheartening when, after a batch, say, of a dozen or even six, have been carefully prepared overnight, it rains so persistently the next day that photography is out of the question, and the plates, from lacking the power to remain uninjured by time, are rendered useless

The Coffee Process —This process, though perhaps not quite so simple as the foregoing, is still very far from being complicated, and is, moreover, entirely free from the drawbacks which characterise dry plates prepared by the washed-plate method Coffee plates, while giving most exquisitely delicate results, are quite rapid enough for ordinary purposes, and possess the additional advantage of keeping their properties unimpaired for almost indefinite periods The coffee process will be described at some length, not only for its intrinsic merits, but also for the reason that it may fairly be looked upon as a representative of all the dry processes in which the use of the bath and of a preservative are prominent features The instructions here given are collated from two articles, one by Mr J H Whitehouse, in "The Year-Book of Photography of 1877," the other by Mr H Mansfield, in "The Year-Book for 1878" Mr Whitehouse, upon whose paper the supplementary views of Mr Mansfield are based, derived his original formulæ, in which he has made but slight alterations, from Mr A Bauernhertz, the associate of M de Constant, with whose name the coffee process is very prominently connected The process, as ventilated by Mr Whitehouse, and supplemented by Mr Mansfield, is as follows A clean dry plate is coated with a substratum of albumen (the white of one egg to about 35oz of water) or edged with indiarubber, as described in Chap I, p 103 When the albumen coating is dry, or, supposing the indiarubber edging to have been used, the benzole or chloroform solvent has evaporated, the plate is ready for collodionising Any good collodion is applicable, but the addition of two grains of bromide of cadmium to the ounce will be found advantageous The sensitising bath should be of an average strength (that is, 35gr to 40gr of silver nitrate to the ounce) and in good working order The collodionised plate should remain in the bath for at least five minutes When the sensitising is complete the plate is immersed in a dish of rain water, containing a few drops of glacial acetic acid The greasy lines formed by the repellence of the washing water by the alcohol in the collodion film having disappeared, the plate may be removed from the dish and rinsed under a tap of ordinary water After a slight draining the following preservative solution of coffee and sugar should be flowed over the still moist film

COFFEE PRESERVATIVE

Pure coffee (finely ground)	1½oz
White loaf sugar (finely ground)	½oz
Boiling water	12oz

This is filtered and used cold It will keep a few days, but quickly deteriorates The plates having been flowed over (preferably, perhaps, a second time) with this preservative, are allowed to dry spontaneously

This may be accomplished by rearing them up against the side of a common box, at the bottom of which a sheet or two of blotting paper, to absorb the drippings, has been laid, and excluding dust by the help of a piece of yellow cloth

When the plates are dry they are either ready for exposure or for storing away in batches, as may be required For the latter purpose, either plate-boxes with V-shaped grooves may be employed, or, if space be an object, and it be desirable to carry the plates for long distances before opening the parcel containing them, a method in which the box is dispensed with may be adopted The following system of package is recommended by Mr Henry Cooper, one of the best living workers in dry-plate photography, whom I have already had and shall again have, the pleasure of quoting in these pages Mr Cooper's directions, which come in very appropriately here, are these "Cut some strips of cardboard a little more than ¼in wide, and glue them down on a piece of silk, strong muslin, or other flexible material, about ⅛in apart When dry, cut with a sharp knife along the centre of each strip of cardboard, thus making a number of strips of flexible material with a strip of card ⅛in wide glued on each edge For large plates the card may be wider The space between the strips should be equal to the thickness of two plates Cut the strips to the length of one side of the plates To pack a dozen plates, lay one on the table face upwards, and, taking two others in the hand, place them back to back (without anything between), and put one of the card and linen guards over each end, lay these on the single one, and then on them place two others back to back as before, without any guards, then two others with guards, and so on until enough are thus laid in a heap, when we finish with a single plate, face downwards It will be seen from this that two guards will suffice for four plates, and, although the faces are kept away from one another by the strips of card, the backs of the plates have nothing between them" To protect the parcel of plates, Mr Cooper wraps it first in very thin sheet gutta percha, then in tinfoil, and finally in good brown paper Mr Cooper adds, with reason, that although, perhaps for commercial purposes, where the packing materials are lost to the seller, this method is too expensive, for amateurs who can use their cardboard guards and gutta percha, &c, over and over again, it is simply perfect.

The keeping qualities of coffee plates are excellent Mr Whitehous mentions that he has kept them wrapped up in American cloth or macintosh in perfect condition for fourteen months, during which time they have journeyed twice across the Atlantic

Coffee plates, being subject to halation, require backing either with

pigment or non-actinic paper, which can be applied as directed in Chapter I, Part II

The exposure of plates prepared by the coffee process, though rather long, is not inconveniently so Mr Whitehouse finds that in no case must the exposure be quite double that necessary for a wet plate Mr Mansfield is on the safe side in saying that his experience does not bear out this assertion At least twice the exposure necessary for wet plates, and in dull light, the action of which is disproportionately slow in starting the image, three times, four times, and even five times the exposure incident to wet collodion under similar circumstances, will not be found excessive

The development of coffee dry plates may be effected in either one of two special ways, both of which will now be given The difference between the two is slight, but in spite of this the results obtained may be widely different in the hands of operators employing one or the other of the respective methods For this reason both the formula used by Mr Whitehouse and that recommended by Mr Manfield will be given in full, and those who fail with the first will, it is to be hoped, achieve with the second that success which coffee plates ought always to command

Mr Whitehouse gives, as the method of development practised by himself, the following Take the exposed negative from the dark slide, and, after removing with a sponge the backing, immerse in a dish containing sufficient depth of water to cover it easily The plate should lie with its film side upwards During the immersion of the plates, attention should be paid to the developing solutions, which are as below

DEVELOPER (1)

No 1	Alcohol	15dr
	Pyrogallic acid	2dr.
No 2.	Distilled water	15dr
	Carbonate of ammonia	2dr
No 3	Distilled water	6½oz
	Pyrogallic acid	15gr.
	Citric acid	22½gr
No 4	Distilled water	3½oz
	Silver nitrate	45gr

These solutions do not deteriorate by keeping To develop a plate by their aid the immersed plate is taken from the dish and the following mixture applied

No 1	20 drops
No 2.	20 drops.
Water	1oz

This will bring out the detail if the plate has been properly exposed, and the latter should now be well and carefully washed Next flow

with an adequate amount of No 3, and after allowing it to remain on the film for a few moments, return it to the developing cup and add No 4 in the proportion of ten or twelve drops to the ounce This intensifier is poured on and off until sufficient density is obtained, when the plate is thoroughly washed, fixed with strong hypo, and finally washed again in the ordinary manner

Mr. Manfield, instead of the No 1 and No 2 of Mr Whitehouse's solutions, uses

DEVELOPER (2)

No. 1.	Pyrogallic acid	3grs
	Distilled water	1oz
No 2	Carbonate of ammonia	1dr
	Hot water ..	1oz

These must be prepared shortly before use No 1 is applied separately, and with its application alone, if the exposure has been correct, the sky and high lights will appear A few drops of No 2 are then poured into a clean developing cup, into which the pyro solution on the plate is also returned The mixture is stirred up with a glass rod and flowed with an even sweep over the film When the detail is thoroughly out density can be obtained as before by the application of an intensifier formed by Nos 1 and 2 of Mr Whitehouse's solutions

Attention should be paid to the second of Mr Manfield's solutions, one drachm, namely, of carbonate of ammonia to the ounce of hot water This is a solution very commonly met with in the development of dry plates, and one the preparation of which in the ordinary way is attended with some inconvenience The following is an ingenious and most simple method by which the use of *hot* water and other drawbacks are entirely dispensed with "Take a bottle of any size, and half fill it with fragments of carbonate of ammonia, fill the bottle with common water, cork tightly, and shake occasionally When developer is wanted, take any quantity of this saturated solution and dilute with half its bulk of water, and as one ounce of water will dissolve about ninety grains of ammonia, this solution will, of course, contain one drachm to the ounce."

The Albumen-Beer Process —This very excellent and trustworthy process was introduced by Captain Abney, to whom and to whose works reference has been made in previous chapters. The following account of the process is taken, with additions, from that given in the inventor's "Instruction in Photography" (London Piper and Carter), and if it be carefully followed through every detail, the operator need have no fear of failure. The exposure of albumen-beer plates is hardly rapid enough for purposes of portraiture, but for ordinary landscape and scientific work they answer admirably, while their certainty of result is an additional

recommendation in their favour The albumen-and-beer process is simply a bath-plate process, with a very excellent and fairly simple preservative To attain, however, complete success in it's practice, it is necessary to follow Captain Abney carefully through all his modifications of the formulæ employed both prior and subsequent to the application of the preservative itself Beginners will very soon find that such modifications, slight as they may appear, are not introdu ced for nothing by one who has so complete a mastery over his subject as Captain Abney. With this caution we will commence our, or rather the inventor's, account of the method of producing bath plates with a preservative of albumen and beer

Some care is necessary in selecting a suitable collodion There are two courses, either of which may be adopted with favourable results The first is very simple, and has been found to increase the sensitiveness of bath plates generally, whether prepared by the albumen, beer or any other process This is as follows If it be desired to put aside a bottle of collodion for dry plate work, take one half of it and "drop into it distilled water to such an amount that on coating a plate the film appears slightly reticulated The remaining half should then be mixed with it, and, as far as the physical nature of the collodion is concerned, it will be found in good condition, the addition of a quarter to half a grain of *nitro-glucose* to each ounce will be found to secure density"

If it be required to manufacture nitro-glucose, this can be done in the following manner Add 1oz of powdered sugar to a mixture of 2 fluid ounces of sulphuric acid and one of nitric acid Stir the mixture for a few minutes with a glass rod, a tenacious mass may thus be collected from the fluid, and washed in warm water by kneading it until every trace of acid is removed

Plates coated with collodion, to which water has been added, should remain for ten minutes in an ordinary 40gr sensitising bath The addition of 10gr of *nitrate of uranium* to the ounce of the sensitising solution is conducive to rapidity, but not indispensable

If the greatest possible rapidity be desired, a special collodion can be made up according to the following formula

Alcohol	4½dr to 5dr
Ether	3½dr to 5dr
Pyroxyline	7grs.
Ammonium iodide	2grs.
Cadmium bromide	5grs

The relative proportions of ether and alcohol depend upon the temperature at which the plates have to be prepared The warmer the weather the greater must be the proportion of the alcohol to the ether,

and *vice versâ* The reason for this is that the additional alcohol makes the collodion set more slowly With the above collodion a 60gr sensitising bath should be used As with the 40gr bath employed with the watered collodion, the addition of 10gr of uranium nitrate to the ounce will be found advantageous to the sensitising solution

It has been found a good plan after applying the special collodion, to sensitise first for two minutes in the 40gr bath, and then in the 60gr bath for ten minutes more

When the sensitising is completed the plate should be washed (see Chap. I, p 104), and attention paid to the application of the preservative, which should be prepared as follows Beat up into a froth a mixture of

PRESERVATIVE

Albumen	1 fluid oz
Water	1oz
Ammonia	1dr

Allow this to settle, and decant off the clear part On the morning of the day on which you intend preparing a batch of plates, uncork a bottle of Bass's ale, and allow it to remain open Ordinary beer or stout will sometimes do, but Bass is more uniform in quality, and consequently safer After the plate has been washed, an adequate amount, say ½oz for a 7½in. by 5in plate of the albumen and water is poured into a clean measure. To this is added ½oz of the beer, which should have been previously filtered The mixture having been stirred, the plate is now taken from the dish in which it has been lying immersed, and flowed over with half the compound of albumen and beer in the measure The excess having been drained off, the flowing is repeated with the other half of the preservative The plate is now washed under the tap for two minutes, and finally covered with

Pyrogallic acid	2gr.
Beer	1oz

The drying of the plate may proceed spontaneously.

The exposure of albumen-beer plates admits of great latitude Under favourable conditions a plate that has been carefully prepared with a special collodion will yield a good negative with as short an exposure as that necessary for an ordinary wet plate It is advisable, however, for a beginner who is not fully acquainted with the characteristics imparted by albumen and beer to rest content with less rapid results than this. One and a half times or twice the exposure necessary for wet plates under similar circumstances will generally be found to insure a satisfactory result from plates prepared as above. Going into the other extreme, it

is interesting and indeed useful to note Captain Abney's remark, that a good negative can be obtained from a plate that has received *twenty* times the minimum exposure necessary!

The keeping qualities of albumen-beer plates are excellent They will remain "good" indefinitely before and at least a month after exposure

The operations of edging the plate before applying the collodion and backing it in order to prevent halation must be conducted in accordance with the instructions given in Chap I, Part II

Before development the backing should be removed and the plate slightly washed in water of a temperature not less than 60° Fahrenheit This done the development is achieved by the help of the following solutions

DEVELOPER

No 1	Pyrogallic acid	12gr.
	Water	1oz
No 2	Liquor ammonia (.880)	1 part
	Water	4 parts
No 3	Citric acid	60gr.
	Acetic acid	30 minims.
	Water	1oz
No 4	Silver nitrate	20gr
	Water	1oz

The following instructions for development are given in the inventor's own words —"To each ½oz of No 1 are added three drops of No 2, and after well mixing with a stirring-rod the solution is flowed over the plate Almost immediately the image begins to appear, and after a few seconds' interval the detail can be seen by reflected light to gradually develop Another two drops of No 2 are again added to the solution, which is once more flowed over the plate. Six drops of No 3 are next dropped into the developing cup, and the solution from the plate poured on to it Again the plate is rinsed, this time by the acid solution, and intensification is given by the use of it with a few drops of No 4 It is advisable not to allow too much detail to come out with the alkaline solution, but to allow a portion of it to be brought out by the subsequent treatment with the pyrogallic acid and silver (see Chap I, Part II) The alkaline developer reduces the bromide salt, and leaves the iodide to be attacked by the silver solution It will be remarked that no restrainer such as bromide is employed, the albumen dissolved by the ammonia plays the part of a retarder, but not as a destroyer of the latent

The fixation of albumen-beer plates may be accomplished either with hyposulphite of soda or cyanide of potassium.

The Collodio-Albumen Process.—This process was originally introduced by Taupenot, and by some is generally connected with his name.

Taupenot's actual formulæ, however, have undergone many and important modifications, and may almost be said to be obsolete Hence the original collodio-albumen process will not have a place in these pages, but will be represented by the modified processes, notably that of Mr James Mudd, of Manchester, by which it has been superseded Mr Mudd has proved the capacities of his process by the production of pictures, the very mention of which is even now a household word amongst photographers. The following account is derived, so far as Mr Mudd's formulæ are concerned, from the "Silver Sunbeam" (eighth edition), which again derives its information, we believe, if not from Mr Mudd himself, from his "Collodio-Albumen Process and other Papers," originally published so far back as 1866 The operations described are as follow :—After applying the substratum (this may not be alsolutely necessary in every case, but is a wise and by no means troublesome precaution), the plate is coated with a collodion which, by preference, should be thin, and containing little or no bromide If it give a thick, creamy film, Mr Mudd recommends dilution with ether, until an adequate degree of thinness is attained When the film has set, the plate is sensitised as usual in an ordinary thirty-five or forty grain sensitising bath The sensitising is succeeded by a thorough washing and immersion for two or three minutes in a solution of iodide of potassium, one grain to the ounce of water The plate should be rocked gently during the immersion, the result of which is the absolute removal of the free nitrate from the film After rinsing with water and draining for one minute, the plate is flowed over with the following —

IODISED SOLUTION OF ALBUMEN.

Albumen	10oz
Iodide of potassium	50grs
Bromide of potassium	10grs.
Ammonia	100 minims
Water	2½oz

To prepare the above solution, the iodide and bromide of potassium are first dissolved in the water, and the ammonia added This solution is then mixed with the albumen, and the whole is beaten up into a froth, and finally allowed to settle for at least twenty-four hours. Before use an adequate quantity of the clear portion is decanted into a convenient vessel The plate is taken while still wet from the rinsing water, and flowed over twice on and off with the iodised solution of albumen. After being allowed to drain for a few minutes the film is dried rapidly before a quick fire, until it is quite hot, as hot, say, as the hand can bear when applied to the back of the plate. If it be requisite to keep these plates for any length of time, they can now be stored away

for future use In any case, however, the plates must be resensitised, an operation which should be carried out in accordance with following formula —

RESENSITISING SOLUTION.

Nitrate of silver	40grs
Glacial acetic acid	½dr
Distilled water	1oz

The plate while still warm is immersed in this solution, drained and washed in different dishes of distilled water, and finally under the tap The plates may be dried either by heat or spontaneously

The resensitised plates keep before exposure fairly well in winter, but not more than a fortnight or so in summer. Between exposure and development they will keep almost indefinitely

The exposure of collodio-albumen plates should be very much protracted indeed From six to twenty, or even thirty, times that necessary for a wet plate, will be found suitable according to circumstances About ten times is a safe exposure in most cases Over exposure is almost impossible

For development will be required a solution made up according to this proportion —

DEVELOPER.

Pyrogallic acid	3grs
Water	1oz.

The exposed plate is well moistened, and the pyro solution poured over it The image will soon appear, and should be allowed to attain detail before the developer is cast aside It will be found, however, that a great lack of density is apparent, and that subsequent intensification is needful This is accomplished by the application of an

INTENSIFYING SOLUTION

Pyrogallic acid	2grs.
Citric acid	2grs.
Nitrate of silver solution (20grs. to oz)	2 or 3 drops

While this is poured over the plate the latter should be kept in motion When the intensification is complete, the film should be washed and the image fixed in hypo-sulphite of soda solution Cyanide of potassium must not be used Re-washing and varnishing should take place as usual

If the plate has been under-exposed, it will sometimes be found that the image may be forced out by using either the pyro-solution or the intensifier, or both, in a warm state. The addition of drops from a 20gr. solution of silver to the intensifier will confer additional intensity

If the sky of a collodio-albumen negative be not sufficiently opaque to

yield a clear print (as is often the case), it may be rendered so by the application of a non-actinic pigment or varnish Semi opaque skies in the negatives may, however, frequently be utilised when printing in clouds by double-printing with a cloud-negative, as described in Chapter XV, Part I

The Fothergill Process —This, like Mr Mudd's process, is a modification of the Taupenot process, but it is a modification with a very important difference This is that the plate does not require resensitising, the first immersion in the ordinary sensitising bath being sufficient The plate is flowed over with a ripe collodion and sensitised as usual After sensitising, the plate is carefully washed to remove all but a trace of the free nitrate in the film When the greasy appearance has vanished, the water is poured off and the plate allowed to drain for a moment It is then flowed over with the following preservative solution of albumen

PRESERVATIVE

Albumen	2oz
Ammonia	20 minims
Water	6oz.

This should be mixed in a large bottle, shaken into a froth, and the clear portion decanted before use It is poured on the plate while the latter is still moist from the washing, and, as in Mr Mudd's process, is flowed on and off twice A final washing succeeds, and the plate is dried either spontaneously or by the application of heat

To develop a Fothergill plate, the film should first be moistened with distilled water, and then flowed over with the following

DEVELOPER

Pyrogallic acid	3grs.
Citric acid	1gr
Water	2oz.
Alcohol	10 minims.

In order to secure density, half a drachm of a fifteen grain solution of nitrate of silver should be added to the above solution The perfect image is washed and fixed in a solution of hypo sulphite of soda

England's Collodio-Albumen Process.—Mr. England's modification of Mr Mudd's process is a useful and popular one Unlike the Fothergill, it necessitates resensitising, but in other respects it is simpler than the method advocated by Mr. Mudd After being collodionised, sensitised, and washed, the plate is flowed over with a

PRESERVATIVE.

Albumen	White of 1 egg.
Water (in summer)	2oz.
„ (in winter)	1oz.

This is prepared as in the Fothergill process, by shaking up in a bottle

capable of holding at least twice as much solution as that requiring agitation Filtration through clean sponge is recommended When the plate has been flowed over with the albumen preservative, it should be washed to remove the superfluous albumen, and then treated with the resensitising solution according to the formula given under that head in the account of Mr Mudd's process In the present case the resensitising bath may be flowed over the plate without any stoppage (see Chap I, Part II), and allowed to remain on the film for one minute Washing and spontaneous desiccation follow The exposure extends, as in the case of Mr Mudd's plates, from six to twenty times that requisite in working under similar circumstances with wet collodion The mode of development may be identical with that recommended by Mr. Mudd

There are other modifications of the Taupenot collodio-albumen process, more or less productive of good results, but little or nothing would be gained by mentioning them here. Indeed, the space already devoted to different methods of working with collodio-albumen is considerable Mr. Mudd's process, Mr England's modification, and the Fothergill method are, however, so representative of the operations requisite in and the results procurable from employing an albumen preservative for the sensitive film, that the accounts given of them respectively are expected to induce operators to strike out modifications for themselves Albumen is a very valuable aid to photography, and is productive of very delicate and exquisite pictures, and it is to be hoped that readers, whilst recognising this fact, will contribute their quota towards increasing the practical value of albumen to the photographer Albumen has already been introduced into the albumen-beer and collodio-albumen bath processes, in a very short time I shall come to the emulsion processes, in which it will again take an honourable if not very prominent place Finally, I shall refer to it in a photo-mechanical process, by which, it is said, most satisfactory results can be obtained Why should not, then, the use of albumen be extended, at any rate, beyond the somewhat narrow limits of its present employment? If the stress which I have laid upon the three processes in which albumen plays a principal part be at all conducive to making our readers think for themselves how photography may be benefited by the further use of a substance of well-recognised value in other branches of science, I shall have reproduced to some purpose the labours of Fothergill, England, and Mudd

To those desirous of practising the collodio-albumen process without experiencing the trouble incident to preparing the plates, it may be of interest to learn that the latter can be purchased ready prepared of J. Pollitt and Co., Barlow-court, Market-street, Manchester

The Gum-gallic Process —This process is the invention of Mr R Manners-Gordon, a gentleman well known by the many and beautiful pictures which he has produced, to the admiration and instruction of the photographic community His name alone would be sufficient recommendation of the process, the present account of which follows in detail the inventor's own directions, as collated in Captain Abney's "Treatise on Photography" (London Longmans and Co) The collodion to be used may be any ordinary sample of standard quality, with the addition of every ounce of collodion of two grains of bromide of cadmium A substratum or edging will be found necessary The plate should remain in the sensitising bath for from seven to ten minutes, according to the heat or coldness of the weather After very thorough washing (especially if the plates are to be kept for any length of time), the following preservative is flowed over the film :

GUM GALLIC PRESERVATIVE

No 1 —Gum arabic (picked)		20gr
	Sugar-candy	5gr
	Water	6dr
No 2.—Gallic acid		8gr
	Water	2or

No 1 is mixed with the aid of heat, and when No 2 has been added to it, the whole must be filtered through thin filter paper of the best and, chemically, purest quality The presence of iron turns the filtered solution to an inky colour The preservative should remain on the film for a minute, after which the plate may be drained and allowed to dry The exposure of gum gallic plates is extremely variable With the strong alkaline developer, when the plate is developed almost immediately after exposure, the same exposure as that necessary for a wet plate will, under favourable circumstances, be found sufficient. Under other circumstances, an exposure varying from four to twenty times that which wet collodion would require, should be given. Development can be carried out either by the alkaline method or by some such modification of the acid iron as the following, the use of, which will be found attended by the best possible results .

GUM-GALLIC DEVELOPER.

No. 1.—Gelatine		64gr
	Glacial acetic acid	oz.
	Water	14oz.
No. 2 —Proto-sulphate of iron		30gr.
	Water	1oz

The gelatine should first be swelled in half the quantity of water given ; the remainder of the water should then be added, boiling. When solution has taken place and the requisite amount of acetic acid

poured in, the whole is ready for decantation into a stock bottle for future use. A short time before use (say, a day or two, but not more) one part of No. 1 should be added to three parts of No 2 Immediately before application, with every drachm of this developer should be mixed one minim of a 30 grain solution of nitrate of silver To develop, the plate is plunged into water of about 70deg Fahrenheit for two or three minutes, and afterwards rinsed with cold water from the tap or jug The developer is now flowed over the film, and additional detail is gained by the further admixture of the nitrate of silver solution Density may be obtained by washing off the developer and applying the ordinary intensifier of acid pyro If the plate be over-exposed, the addition of No. 1 solution will be found to act as a restrainer Gum-gallic plates are capable of producing very beautiful results, but are unsatisfactory in moist temperatures, the damp producing a fungoid growth on the film, which renders the negative unfit for printing purposes.

The Tannin Process —The following process was popularly introduced by Major Russell, with whose name is also associated the application to dry plates of the alkaline method of development The tannin process has in its time enjoyed a wide popularity, and even now there are many so wedded to its practice as to prefer it to more modern developments of dry-plate photography. "Russell" dry plates are still produced commercially by Mr. W W Rouch, of 180, Strand, but though the tannin preservative is presumably a prominent feature in their preparation, the plates, I am informed, are coated with an emulsion, and the sensitising bath is no longer employed in connection with their manufacture The following is an account of the method of making bath plates by the tannin process The plate, after being treated with a substratum or an edging, is coated with any good sample of ordinary bromo-iodized collodion. If a special collodion be desired, the operator will do well to follow Major Russell's own formula, which runs thus ·

BROMIZED COLLODION

Alcohol	5oz.
Ether	5oz
Pyroxyline	50gr.
Bromide of cadmium	150gr

This collodion, it will be remarked, contains only bromide After thoroughly sensitising until the film attains an uniformly creamy appearance, the plate is well washed in two changes of water It may then be transferred to the following solution of tannin and sugar:

TANNIN PRESERVATIVE.

Tannin	300gr.
Loaf sugar	300gr.
Water	20oz.

This is placed in a large bottle and shaken until complete solution takes place. After filtration an ounce of alcohol is added. The bottle should be kept carefully stoppered when the solution is not in use, and the latter may be used, with occasional filtration, over and over again. The plates may remain in the tannin preservative solution for two or three minutes. Major Russell suggests, as an improvement on the original tannin process, that, previous to the immersion in the tannin preservative solution, the plates should be immersed in—

Albumen	24min
Distilled water	12oz
Iodide of cadmium	6gr
Bromide of cadmium	1dr
Camphor	1dr.

The plate may remain in this bath for one or two minutes. Its object is said to be twofold. "Firstly, the albumen acts like sizing to paper, by rendering the collodion film less porous or permeable to fluids than it was before; secondly, the cadmium salts remove every trace of unaltered iodide of silver. The iodide of cadmium, too, is intended to introduce a trace of iodide of silver into the film," which is in some way regarded by Major Russell as beneficial. In spite, however, of these advantages, there are many operators who do not use this preliminary bath, but prefer the simpler method of transferring the plate at once from the washing to the tannin preservative solution. Those who employ Major Russell's preliminary bath, wash the plate a second time before immersion in the tannin preservative. After the latter has taken place the plate is washed a third time and allowed to dry. The exposure of tannin plates may be roughly stated to be about equal to that of gum-gallic plates, but everything depends upon the mode of development employed. The developer may be an alkaline one. The following is the formula sent out by Mr. Rouch with the "Russell" plates, and may be recommended as lessening the exposure to a considerable extent:

ALKALINE DEVELOPER

No. 1.—Bromide of potassium	15gr.
Water	1oz
No. 2.—Liquor ammonia fortis	1oz
Water	1oz.
No. 3.—Pyrogallic acid	8gr.
Water	1oz.

No. 3 should be made up freshly as required. To develop a half-plate, flow over the film and return to the bottle a mixture in equal parts of methylated spirit and water. Now take 1oz. of No. 3 and add to it five or six drops of No. 1. Pour over the plate and return to the developing cup. Add a drop or two of No. 2, and again flow over the film. If the exposure has been correct, the image will now speedily appear. In

cases of under-exposure, and to secure density, add further drops of the ammonia solution. If the plate has been over-exposed, the addition of the bromide solution will have a restraining influence. If desired, intensification can be accomplished with acid pyro and silver

With the tannin I conclude my account of the bath-plate dry processes in vogue There are others, it is true—indeed, there are many others—but all of those are either obsolete, or unimportant modifications which have failed to supersede the original processes upon which they were founded. I might have mentioned a tea process, where the preservative is constituted by a strong infusion of black tea, a process which rejoices in a preservative decoction of poppy seeds, a tannin and honey process, a resin process, a gelatine process, a raisin process, and a host of others But I have given a full account of all the most important bath-plate processes, and if the intelligent operator wishes for any more, he has but to create modifications for himself I will now bid a last farewell to the sensitising bath, with all the ills, annoyances, impurities, provocations to anger, and other unseemly attributes appertaining thereunto, and turn to the processes grouped under the common heading of Emulsions



CHAPTER III.

EMULSIONS.

THE word emulsion is a derivative of the Latin *emulsus*, the participle past of *emulgere*, to milk out It signifies a milk-like mixture, and the first sight of such emulsions as those we are shortly about to describe will convince our readers that, at any rate so far as appearance goes, the name is a very appropriate one In photography the term emulsion is applied to a mixture compounded of sensitive salts, such as bromide of silver, held in suspension in some such substance as collodion, or, as will be shown in a future chapter, gelatine It is proposed to discuss first the different forms of emulsion which are based upon the employment of collodion, and are hence known as collodion emulsions

The learner must commence by distinguishing between the two primary kinds of collodion emulsion In order to make this distinction thoroughly and unmistakably clear, it will be necessary to give a slight outline of the methods by which they are variously manufactured Roughly speaking, a collodion emulsion is a compound of pyroxyline (gun cotton), alcohol, ether, nitrate of silver, and a bromide, such as that of cadmium or zinc The pyroxyline, alcohol, and ether form a plain collodion, the fusion of the bromide with the nitrate of silver produces a bromide of silver. Thus we have exactly what we require—a sensitive salt held in suspension in a collodion. But the crux is that there is something else besides this, which we do not require The mixture of the bromide with the nitrate of silver produces not only a bromide of silver, but also a superfluous nitrate of zinc or cadmium, as the case may be The point, then, is to get rid of this unnecessary and, indeed, injurious nitrate, and upon the different methods of accomplishing this end are based the two names by which collodion emulsion is generally known For example, by one method the sensitive collodion when prepared is merely allowed to ripen, and then, after filtration, is poured direct upon the plate. The free nitrate in this case is got rid of by washing the plate. This process, inasmuch as the collodion itself previous to coating

undergoes no washing whatever, is called an unwashed emulsion process In a washed emulsion process, on the other hand, the sensitive collodion after ripening is poured out to set Evaporation of the ether and alcohol shortly takes place, and a mass of *pellicle* remains This pellicle is now rid of the free nitrate by simply soaking it in several changes of water After this the pellicle is dried and then redissolved in the proper proportions of ether and alcohol As the free nitrate has already been disposed of, it is obviously unnecessary, when using a washed emulsion, to wash the plates subsequently coated by it

A third method of removing the free nitrate is by precipitation, and is based upon the experiments of M Chardon The process consists in pouring the collodion from a height in a thin stream into a basin of water This method, however, is not in very general use, and as the results accruing to it may hardly be said to surpass those obtained by the ordinary modes of washing, we shall not enter into any details of the process.

I should hardly care to embark fairly upon the subject of emulsion without making some allusion to Captain Abney's lately published little work on "The Emulsion Processes in Photography," which forms No. 2 of Messrs Piper and Carter's series of Photographic Handy Books This is a comprehensive manual of everything relating to emulsion work, for Captain Abney goes fully into scientific principles as well as practical details In a word, the book is one which ought to be on the shelves of every worker in dry plate photography

And now let me turn the attention of my readers to the actual working of the emulsion processes. As usual, it will be necessary to introductorily enumerate and discuss the various preparations and appliances incident to their practice. To this end, although I shall commence with unwashed emulsion, and shall relegate the washed emulsions to a separate chapter, I will for the present consider collodion emulsion as a general subject, and, to save repetition, will at once proceed to give all, or nearly all, the necessaries required in its more usual forms of practice.

To begin with, of course the basis of an emulsion process is the emulsion itself. This can be made at home, or can be purchased ready-made and washed from various photographic establishments Information as to the commercial emulsions in vogue will be given in the course of the present series. For those who desire to make their own emulsion an undertaking by no means formidable, and very strongly to be recommended), a first care will be to prepare a *plain* collodion. The ingredients of this are pyroxyline, ether, and alcohol, the proportions will be given hereafter, as they vary according to the process followed.

Taking the ingredients themselves, we have first to consider the pyroxyline, where it is to be obtained, and what quality is suitable to an individual process. In reply to the first question, it may be said that pyroxyline can be procured with ease through any local chemist. At the same time it should be added that, as a rule, it is the wiser and better plan to procure it from a photographic dealer, whose pyroxyline is sure to have been prepared at a known temperature, with a known strength of acids, and with a special view to photographic requirements Of course it is possible for the operator to manufacture his own pyroxyline, but photographers are almost unanimous in looking upon this as a procedure ninety-nine times out of a hundred unsatisfactory and even dangerous. The quality of the pyroxyline requires special consideration. As a general, perhaps indeed, infallible rule, it may be said that for an unwashed emulsion the pyroxyline prepared at high temperature is best suitable, while the ordinary quality, as recommended by the dealers themselves, will be found in washed emulsion to yield the best possible results Mr. W W Rouch, of 180, Strand (at the corner of Norfolk-street), sells pyroxyline, both ordinary and high temperature, of standard quality, at 2s. 6d an oz The beginner will find it useful to keep both qualities in stock for experimentation and emergencies A good plan is to use up nearly all the pyroxyline purchased in making stock plain collodion according to any adopted formula With regard to the alcohol and ether, it will be found necessary to keep in stock at least a pound of absolute alcohol, the same quantity of rectified spirit (830 sp gr), and perhaps half a gallon of methylated spirit. A pound of absolute ether (sp gr ·725) and a pound of methylated (720 sp gr) will also be required. Absolute alcohol costs about 5s 6d. a pound, methylated 5s. a gallon , absolute ether is sold at about 6s. a pound, the methylated at about half-a-crown.

The collodion having been disposed of, it remains to discuss the additions to it which form the emulsion The nitrate of silver, of course, is the principal of these, and can be procured in accordance with suggestions offered in a former part of this work. For a bromide, Canon Beechey uses that of cadmium in his unwashed process, whilst in making washed emulsion it is usual to employ bromide of zinc The cadmium bromide should be anhydrous (that is, free from water), and should cost about half-a-crown an ounce Bromide of zinc is about sixpence less

The dry-plate worker's laboratory should contain 1lb. of hydrochloric, and the same quantity of nitric acid. These will cost about 6d. and 1s. a pound respectively.

Before coating the plates, a substratum will be found necessary in every case where collodion emulsion is employed. This substratum may

be applied by any of the methods recommended for bath-plates. In using washed emulsion, a preliminary rubbing with French chalk will often be found sufficient, but with unwashed emulsion, or in other cases, where the plates themselves will be subjected to much immersion, it will be needful to employ a substratum of albumen, or, in our opinion, preferably, an edging of indiarubber Mr. Cooper's new gelatine substratum will be given under the heading of that gentleman's excellent new process of washed emulsion

The chemicals required in the development of emulsion plates by the alkaline method are, in addition to the methylated alcohol already mentioned, pyrogallic acid, of which an ounce or two should always be kept in stock, if only for the reason that in conjunction with beer it forms an excellent preservative, liquor ammonia fortis, which should be bought by the pound of the strength known as ·880; carbonate of ammonia, which is often used in preference to the liquid, as giving less inky pictures, bromide of potassium, to act as a restrainer, citric acid, to be used in conjunction with pyro and silver for intensification; and, lastly, hyposulphite of soda or cyanide of potassium for fixing. The beginner is strongly recommended to have a case specially made to hold bottles, &c, containing small quantities of these chemicals. This will allow him to carry on operations with ease at any distance from home, and, if the plates are prepared and developed at night, will practically obviate the necessity of a dark room

The above is a complete list of the principal preparations connected with the washed and unwashed emulsion processes Any further ones that may be requisite are only so under exceptional circumstances, or are employed in processes considered either wholly obsolete or superseded.

In the way of apparatus little will be needful beyond the few appliances already mentioned in Chap. I., Part II. In making the emulsion a few Florence flasks and test tubes will be found convenient, while the same may be said of an ebonite dish for development, and a porcelain or glass one for intensification. The size of these dishes may be 5in. by 4in. for quarter-plates, 8in. by 6in. for half-plates, and so on in proportion.

If it be wished to dry the coated plates rapidly, a useful course to adopt is that recommended by Mr. Woodbury That gentleman, who is a clever practical operator, as well as a skilled scientist, uses a simple apparatus compounded of a little iron tripod and a small piece of sheet iron. The latter is levelled upon the former, a spirit lamp is introduced beneath, and the plate is desiccated by the heat equably radiated from the iron. If a doubled piece of blotting paper be laid upon the iron the plate may rest upon that with impunity.

Some emulsion plates being extremely sensitive, and moreover requiring

development with a very powerful developer, necessitate the employment of a highly non-actinic light. A paraffin lamp with a ruby chimney, or an ordinary candle with a ruby or even yellow shade, may be used with safety and comfort

I will now bring before my readers a type of unwashed emulsion processes in the shape of that which is familiarly known by the name of Canon Beechey, by whom it was introduced to the notice of the photographic world at large

Canon Beechey's Unwashed Emulsion Process —This simple and most admirable process was published by the inventor in the *British Journal of Photography* of 1st October, 1875 It has had many followers, especially among amateurs, and deserves particular recommendation, not only for its general simplicity and freedom from perplexing eccentricities, but also for the really beautiful results which are obtainable by its aid In a word, the "Beechey" process, as it is familiarly called, is easy, fairly rapid, and gives in good hands pictures which the most skilful artist in wet collodion would be proud to have produced Technically speaking, the process consists, firstly, of a bromised collodion emulsified with nitrate of silver, secondly, of plates coated with this emulsion, thirdly, of films out of which the superfluous nitrate has been washed by immersion, fourthly, of washed films treated with a preservative, endowing them with the quality of remaining uninjured by time for an indefinite period between preparation and exposure, and for some few days at least between exposure and development The directions laid down by Canon Beechey are substantially as follow The requisite number of glass plates are carefully cleaned and treated with a substratum by any of the methods in vogue Canon Beechey originally recommended albumenising, others prefer the edging of india-rubber immediately previous to coating A writer in the "Year Book of Photography" for 1877 makes a solution of gelatine, one grain to the ounce of water, and having dipped the clean plates bodily in, takes them out immediately and sets them to drain. The advantage of this plan is that the plate can subsequently be coated on the side freest from imperfections. The next step is to prepare a stock solution as below

BROMISED SOLUTION

Bromide of cadmium	drs.
Absolute alcohol	oz.
Hydrochloric acid	1dr.

The bromide is first dissolved in the alcohol and allowed to settle for at least twenty-four hours. It will deposit a white powder. After standing, the clear part is carefully decanted into a fresh bottle, and the

hydrochloric acid added The quantity of bromised solution prescribed will, as Canon Beechey says, last the beginner two or three years, it being sufficient for nearly 40oz of emulsion, or, in other words, for about thirty dozen half plates When it is desired to prepare a batch of plates, say a couple of dozen of 6½in by 4¾in, the following operations will be all that are necessary Having entered the dark room, an ounce of the rectified spirit (820 sp gr) is poured into a test-tube or small Florence flask, and 10grs of nitrate of silver dropped into it The silver is now dissolved by the aid of heat, the flask being rested on a retort stand over a spirit lamp or placed in a saucepan of hot water It should be remembered by the beginner that alcohol has the property of boiling at a much lower temperature than water Whilst the alcoholic solution of silver is being heated, the operator may prepare as follows a

BROMISED COLLODION

Bromised solution (as above)	½oz.
Absolute ether	1oz
Pyroxyline	12grs

The pyroxyline should be that prepared at high temperature, and should dissolve at once in the bromised alcohol and ether on a shake being given to the bottle And now comes an important part in the carrying out of the Beechey process, namely, the emulsification The bromised collodion is poured out into a clean four ounce measure, and a clean strip or rod of glass held ready for stirring in the right hand With the left hand is grasped the test tube, or flask, containing the hot solution of silver, and the latter is poured in a continuous stream into the measure containing the collodion During the pouring the emulsion is briskly stirred in order to obviate all lumps or deposit The emulsification having so far been accomplished, the emulsion is poured into a small bottle of four or five ounce capacity, and allowed to ripen in a dark place with an occasional shaking for twenty-four hours At the expiration of this time the emulsion will no longer be milky as it was when in the measure, but creamy and opaque to transmitted light

It may be remarked, for the benefit of beginners, that in making the bromised collodion it is by no means necessary to add the bromised solution immediately before emulsification Indeed, it is a good plan to make a stock, say 10oz or 20oz. of the bromised collodion, and decant off any given quantity as required. It may well be added here that the bromised collodion, according to Canon Beechey's formula, is obtainable in commerce. Mr. W W Rouch, who makes a speciality of the Beechey process, sells bromised collodion prepared according to this or any other formula at 3s. 9d. for 10oz. There are many, perhaps, to whom this information will be new, and at the same time welcome, as affording

almost without increase of expense a means of saving trouble, space, and time.

A most convenient plan of practising the Beechey process, especially for those whose dark-room accommodation is limited, is to emulsify a given quantity of collodion one evening, allow it to ripen through the night and the following day, and on the next evening coat the plates. If the bottle containing the emulsion to ripen be placed in a box, or in a turned light-tight bottle case, the emulsion may of course be agitated by merely shaking the box or the case, and there will practically be no need for the dark room at all.

After the emulsion has ripened, the actual coating of the plates can thus be proceeded with. The allotted number of plates is prepared, and laid ready to hand side by side with a pneumatic plate-holder, preferably of the lever form, or, if of the "globe" kind, constructed so as to stand without rolling over. If the plates have not already been gelatinised or albumenised, the bottle of indiarubber dissolved in chloroform must also be on the spot with its attendant brush. The emulsion is now thoroughly well shaken, and filtered through cotton-wool into a perfectly clean pouring bottle. Care should be taken to avoid all air bubbles, and those formed by the shaking previous to filtration should be allowed to subside before the filtration takes place.

At this point it will be well to allude to a slight "trick" of practice which the emulsion worker will always find of the highest convenience and even value. This refers to the funnel employed for filtering the emulsion. Beginners especially will find that filtering emulsion through the ordinary glass funnels is productive of much difficulty in cleaning, and is attended, moreover, by a constant liability to breakage and other unpleasant contingencies. The practised emulsion worker generally eschews glass funnels and substitutes for them a contrivance quite as effectual and very much more convenient. He takes a small piece of note paper, say about 2in. square, and twists it up with his fingers into a shape identical with that in which silkworms are so often set to spin their cocoons. This is the emulsion worker's funnel, and a very useful little piece of apparatus it is. If required the twist may be secured with a black enamelled pin, but not with a white one, as that would cause black streaks of reduced silver on the plates. The cotton wool should not be stuffed too heavily into the funnel, and the latter, if of paper, should be cut level at the top, and a piece of thin cork lightly superposed, to prevent evaporation of the ether. When the coating of the plates is completed the funnel may be thrown behind the fire.

And now for the actual coating of the plates. One of the latter is attached to the plate-holder and held by it in the left hand. If not

already treated with a substratum, a brush charged with the india-rubber solution is run lightly round the edges of the plate to the depth of about ⅛in The chloroform evaporates almost instantaneously, and leaves a viscous edge of indiarubber, which will cause the collodion film to adhere to the plate with extraordinary tenacity. The pouring bottle is now taken in the right hand, and the lip held so low as almost to touch the plate This will allow the emulsion to flow smoothly over the plate without air bubbles The plate having been coated, the excess is poured off, *not* into the pouring bottle, but into the stock bottle, in which the emulsion has been ripening This is a most important point, which, if neglected, will be attended by most unpleasant consequences in the way of spots, the emulsion worker's most terrible bugbear

It now remains, the emulsion having set, to wash the films thoroughly until all trace of greasiness disappears, and then to apply the preservative The latter is prepared as follows —A pint and a half of table beer is procured, and with it is mixed thirty grains of pyrogallic acid The beer should not be quite flat, and not acid. Canon Beechey uses ordinary bitter beer, but Captain Abney, commenting upon the process, recommends sweet beer in preference, the saccharine matter possessing superior preservative qualities The preservative should be filtered before use, and care should be taken, as with the emulsion, to avoid all bubbles

Canon Beechey adopts a very simple and excellent plan for washing and applying the preservative He has two porcelain dishes, each large enough to hold six, or four, at least, of the plates about to be coated One of these is nearly filled with clean filtered rain or distilled water, the other with the preservative Operations now go on as follow The first six plates (if the dishes will each hold six) are coated in succession, and, as coated, laid in the dish containing the washing water By the time the sixth is in the first will be ready to be taken out Having taken it out, a look must be given to see if the greasiness has quite disappeared. If so, the plate is dropped into the second dish containing the preservative. Canon Beechey continues "Coat another plate and put it in the water where the first came out. Remove your second plate from the water into the preservative, and in its place lay another freshly-coated plate, and so on, until the first six are all in the preservative, and six more in the water You now take the first plate out of the preservative into your drying box, and again remove the first out of the water into the vacant place in the preservative. Coat another and put it into the vacant place in the water Take your second plate out of the preservative into the drying box, and the second out of the water into the preservative, and so on till all your plates are through the process and locked up safely in the drying box. By

proceeding as above not a moment of time is lost, and yet each plate soaks sufficiently in the water and in the preservative You will find an hour, if you are dexterous, sufficient time for two dozen plates"

Those who do not possess a drying box will find it convenient, after taking the plates out of the preservative, to range them one by one against a wall or the side of a box When the batch of plates is completed a spirit lamp may be lit, and each plate dried separately by Mr Woodbury's plan, mentioned in the earlier part of this chapter When dried the plates may, of course, be stored away in dark slides, plate boxes, or in a changing box, or all three, as may suit the operator's convenience, and the means at his disposal

The exposure required by Beechey plates is fairly rapid In a good light thirty seconds will be found sufficient when using the ordinary developer, from forty to sixty seconds will be necessary when the light is wanting in strong actinic quality Canon Beechey mentions that he does not "back" his plates, as he finds they will not blur with any light that will not also blur backed plates This is doubtless owing to the great opacity of the film.

The formula for developing Beechey plates is that originally introduced by Colonel Stuart Wortley, and known as the

STRONG ALKALINE DEVELOPER.

A.	Pyrogallic acid	96grs
	Alcohol	1oz
B.	Bromide of potash	12grs
	Water	1oz
C.	Carbonate of ammonia	4grs
	Hot water	1oz

It is recommended *not* to use liquid ammonia in preference to the carbonate unless the picture be fully exposed. Canon Beechey's own directions for development are as follow: "For a half-plate, take of A thirty drops, of B sixty drops, of C two drachms, or even three if the exposure be short. I never use any alcohol, but simply wet the plates well under the tap, thereby washing off the beer, and pour on the developer. The picture will come out in a few seconds On its first appearance, pour back the developer into the measure, and let the picture come out of itself. You will be surprised to see how it *will* come out. You can then judge as to exposure and proceed accordingly, adding bromide if too rapid, or pouring on the developer as it was if all right, or with an extra thirty drops of C if under exposed. These plates seldom require to be intensified If they do, the ordinary acid silver and pyro-redeveloper will bring them up easily and at once. Clear with either hypo or cyanide as you please, and, if you intensify, do it after clearing; but the beer gives these plates a bottle-green tint,

which is more impervious to actinic light than from its transparency you would suppose. These plates are more rapid if placed at once in the preservative without washing, but they require to stay till all greasiness has disappeared, and I doubt if they keep so well or are so certain To wash first is safest for amateurs."

"Beechey" plates will keep almost indefinitely between preparation and exposure, but, once exposed, the sooner they are developed the better If left undeveloped for more than three or four weeks the latent image seems to lose its proper vigour

Both plates and emulsion (washed), prepared according to Canon Beechey's formulæ, are obtainable of Mr W W. Rouch We are indebted to Mr Rouch for the suggestion that when working with Beechey plates the exposure may be greatly curtailed by using no bromide at all in the developer Beechey plates may also be developed by the aid of ferrous oxalate, for which a formula has already been given.



CHAPTER IV

Washed Collodion Emulsions—A Standard Process—Preparation of the Plate—Coating—Drying, &c

The system of "washing" emulsions was first published in the *British Journal of Photography*, for 16th Jan , 1864, by its present editor-in-chief, Mr W B. Bolton Since that time, by the strenuous exertions not only of Mr. Bolton, but also of many another ardent yet careful experimentalist, the process has reached a pitch of perfection which literally seems incapable of advancement Upon the various steps which have led to this happy result neither space nor the scheme of the present work permit us to expatiate I can, however, refer my readers to the *British Journal of Photography* Almanac for 1879, which contains an article by its then editor, Mr J Traill Taylor, on "The Rise and Progress of Collodion Emulsion," combining lucidity of expression and grasp of the subject in a manner beyond my ability to improve upon It only remains for me to lay down a clear, concise, and definite course of instruction as to the manufacture and employment of washed emulsion by methods which are results rather than examples of varied experimentation. The numberless formulæ which have already been published with a view to the furtherance of this branch of photography are of much historical interest as showing the gradual stages of development, and as affording reliable data for further successful research, but with some few exceptions their merit, from a practical point of view, is of a purely individual nature. For any peculiar process to become really popular it must not only be capable of producing standard, and even excellent, results, but, above all else, it must be simple. A formula swelled out by never so few unfamiliar components—a system of work necessitating but one additional and difficult manipulation—may be patronised by ten, but not by a thousand. In introducing the subject of washed emulsion to the readers of his excellent "Treatise on Photography," Capt. Abney strikes the keynote of success, when he remarks, "There are almost endless varieties of preparation, but experience seems to show that the simpler the formulæ are kept, the more certain are the results." As an

acknowledgment of our practical appreciation of this remark, we should add that the first of the following processes may almost be assigned to Captain Abney himself, so far as the simplicity and efficacy of most of the actual formulæ are concerned The details of the intervening operations in all the various processes are nearly identical, and are the common property by right of usage of all who, in the capacity of either tutor or disciple, may have need to refer to them

Before plunging at once into the practical details of the subject, it will be necessary to understand clearly the ends at which we are aiming In the first place, it has already been hinted at that the general object in preparing a washed emulsion is to provide a sensitive collodion, which, when poured upon a glass plate or other convenient medium, will, without further washing, produce a sensitive film equivalent to that obtained by the use of ordinary collodion in combination with a sensitising bath. In the second place, the process by which this sensitive collodion is to be prepared, must be simple In reference to this requirement, we can only remark that there is nothing in any of the processes about to be detailed that ought to puzzle even the humblest of amateur photographers. So far as is possible, the operations have been reduced to mere mechanical efforts; all else that is wanting is, firstly, good chemicals, which are easily and cheaply to be procured, secondly a trifling amount of care, neatness, and, above all, strict undeviating attention to the rules laid down in every case, however insignificant The third qualification of a good washed emulsion is that it should present every facility in its after-working It should be fairly rapid, as rapid, say, as wet collodion under favourable circumstances For all ordinary cases this will be found amply sufficient Personally I use washed collodion emulsion for every class of work where a moderate degree of rapidity is required In cases where extreme rapidity is necessary, it is found convenient to employ plates prepared with an emulsion of gelatine, which will be fully described hereafter The following collodion emulsions will all give results nearly, if not quite, as rapid as wet plates A great advantage to be derived in working with dry collodion is ease and latitude of development. This point will be more fully apparent later on With regard to the excellence of results obtainable in the following processes, I must leave my readers to judge for themselves If they fail to meet with success, they may rest assured that it is solely their own fault, and not that of the process This is a fact which the mere mention of the names of Captain Abney, Mr. Henry Cooper, and Mr William Bedford, as the actual foster-fathers of the respective processes themselves, places beyond all manner of dispute or doubt After these few introductory remarks, the gist and purpose of which have, I trust, been fully com-

prehended and laid to heart by my readers, I will proceed to the details of preparation of a washed emulsion by three different processes which are eminently representative, and from which can doubtless be evolved a sufficient number of modifications and ramifications to amuse or distract any number of experimentalists to the end of time I shall call the first of these a "standard process," partly because it is so, and partly from the fact that from the number of fingers which from time to time have contributed to the manufacture of this particular "pie," it cannot, without committing injustice, be assigned as the entire production of any one mind or any separate course of experimental research

Bromised Collodion.—The first step is to prepare a stock of bromised collodion which may be made up in any quantity according to the following formula

BROMISED COLLODION

Pyroxyline ..	24grs.
Bromide of zinc	40grs
Alcohol 820	1oz
Ether, methylated . ..	1oz

For the rectified spirit a good sample of methylated may be used if desired The collodion may advantageously be made up in quantity and kept in tall graduated bottles, in order to allow any given number of ounces to be measured off at any time with ease and exactitude The pyroxyline, it may be repeated (see preceding chapter), should be of the kind known as *ordinary* by photographic dealers

Emulsification —To make 5oz of emulsion, proceed as follows Take 2½oz of the above bromised collodion and set it aside in a good-sized glass measure, or other similar vessel A glass stirring rod, such as can be procured of any chemist at about 2d. per foot length, is also placed ready for use; 83grs of silver nitrate are now to be weighed out and powdered. It will be found that this quantity will be sufficient to combine with the zinc bromide so as to form silver bromide, and at the same time to allow an excess of 3grs of silver nitrate to each ounce of the collodion. The powdered nitrate of silver is transferred to a Florence flask, a test tube, or to one of the little decanter-shaped bottles, made of test-tube glass, which should be procurable of any dealer, and which are of constant use in the laboratory or dark room. To the silver is added 1½dr of water; the vessel is placed on one of the rings of a retort stand, and a lighted spirit lamp introduced at some distance beneath it. When perfect solution has taken place, seventeen drops of nitric acid should be added. In a second test tube or bottle 1oz of alcohol (·820) is heated over the lamp or by merely dipping the vessel into warm water The alcohol is now poured upon the nitrate of silver solution and the mixture slightly agitated in order to facilitate combination. While still

hot, and before the silver has had time to recrystallise, the solution is poured in a thin continuous stream into the vessel containing the collodion The collodion should be stirred vigorously during the emulsification The pouring bottle should be held in one hand and the stirring rod in the other. When the latter is complete, the emulsion, for so the sensitised collodion may now be called, should be transferred to a bottle capable of holding at least 10oz. (a "reputed" pint beer or champagne bottle, for instance), and either well wrapped up in paper or otherwise protected from the ingress of actinic light.

Ripening —The next step is the "ripening" of the emulsion This is allowed to continue for from sixteen to twenty-four hours The longer period will conduce to a little extra sensitiveness in the finished emulsion The emulsion may advantageously be shaken once or twice during the time allowed for ripening, but this is not imperative.

Washing —After ripening comes the representative operation of the process, namely, the washing. This is performed in the following manner A porcelain dish of whole plate or, preferably, of 12in by 10in size, is taken into the dark room. Into this the emulsion is poured direct, so as to form a shallow pool Almost immediately the alcohol and ether begin to evaporate, and a skin is formed on the surface of the pool of emulsion This is broken up with the glass rod in order to accelerate the evaporation This breaking up should be continued at intervals until the emulsion is transformed into fairly consistent lumps of pellicle, from which the ether and the alcohol have as far as possible evaporated These lumps are now scraped together, transferred to a glass vessel, and the latter filled up with distilled water. The lumps of pellicle, if the evaporation has been properly carried out, should sink to the bottom. After soaking a few minutes, the first wash water may be drained off and a fresh quantum substituted for it. The water may be changed every quarter of an hour, until it shows only a slight milkiness when treated with a drop or two of hydrochloric acid. This result being obtained, the water is finally drained, and the washed pellicle laid on a piece of calico and wrung until as much moisture as possible is extracted If preferred the calico can be also used as a strainer, by being stretched over the mouth of the glass jar in which the pellicle is washed

Drying the Pellicle.—The pellicle can now be further desiccated either with the aid of gentle, not excessive, heat or spontaneously upon blotting paper. Captain Abney recommends that after as much water as possible has been squeezed out of it, the pellicle should be covered with rectified spirit, ·820. "In an hour's time the excess is drained off, and the pellicle is squeezed in the cotton rag as before. It is then once more covered with the spirit and left for half an hour, when, after draining away the

superfluous spirit, it is ready for re-emulsifying If it be desired to keep the pellicle in a solid state, it will only be necessary to expose it to the air for a few hours, when it will be found quite dry "

It may here be mentioned that the pellicle will keep indefinitely, a quality which sometimes is very convenient To those who wish to keep miscellaneous quantities of pellicle always by them, it will be useful to remember that the proportion of pellicle to solvents is about 6grs of the former to an ounce of the latter

In order to prevent the waste of the first solvents they may be preserved by the employment of a still The method is, however, somewhat tedious, and, looking at the low price of methylated spirit and ether, can only be recommended when the emulsion is made up in large quantities, as, for instance, in commerce For the amateur who only makes up 5oz or 10oz at a time it is doubtful whether the saving in solvents would compensate for the trouble of the operation and the cost of the still Those who see their way to effect a marked saving in this respect will find the subject practically discussed in pp 38, 39 of Captain Abney's "Emulsion Processes in Photography," or in an article by Professor Stebbing on pp 60, 61 of the *British Journal of Photography* Almanac for 1878

Re emulsifying —To convert the amount of dried pellicle obtained by the formulæ and proportions above indicated into emulsion, it is only necessary to place it in a bottle and add to it 2½oz of absolute alcohol and the same quantity of good methylated ether In order to effect perfect combination, the emulsion should be shaken violently for, say, ten minutes at a stretch This done, the photographer has in his hands a washed emulsion which will keep indefinitely, and which will produce good pictures with ease and rapidity to the last drop

Before proceeding to coat a batch of plates, it is as well to coat a few trial ones, in order to see if the emulsion flows easily and works cleanly with the ordinary developer If it flows thickly and with difficulty, more solvents should be added If, on the contrary, the emulsion from some accident be too thin, the solvents may be allowed to slightly evaporate until the requisite consistency is obtained If any fault is to be found in the working of the emulsion, a drop or two of tincture of iodine (made up by dissolving three or four grains of iodine in 1oz. of alcohol) may be added to it. None of these after remedies ought, however, to be needed. They are only given here in order that my readers may feel secure in the thought that the remedies, if needed, are at hand, and are, at the same time, neither tedious nor difficult of immediate application.

Preparation of the Plate.—Having brought the manufacture of the washed emulsion, it is hoped, to a satisfactory conclusion, it is now

time to turn our attention to the preparation of the plate to which the emulsion is to be applied The preliminary operations are nearly, if not quite, the same as those previously explained in connection with the Beechey and other processes In the first place, the plate should be perfectly clean and of good quality In the second place, it should have a substratum of albumen, gelatine, or of very dilute indiarubber, a polish with French chalk, or, failing these, an indiarubber edging, as described in previous chapters The worker in washed emulsion, where a preservative is not used, will find French chalk, steotite, or soapstone, as it is variously called, a most convenient substitute for a substratum All that is necessary is to sprinkle a small quantity over the surface of the plate and literally to rub it off again with a duster until no speck remains A final polish with a handkerchief or clean leather may be given, and the plate is ready to receive its coating of emulsion French chalk should, if possible, be procured from leather stores, or from a dealer in direct communication with them, in order to avoid adulteration, accidental or otherwise, with substances injurious to photographic success I may here remark that in preparing a batch of dry plates with an emulsion, it is very convenient to have an assistant, even though he or she be utterly ignorant of photography itself Cleaning the glass plates, rubbing them over with French chalk, and rearing them up to dry when coated, can all be managed almost by a child, while if the operator does everything himself, he will find the continuity of his operations seriously affected without any increase of satisfaction or success To those who are not blessed with a spacious dark room, we recommend the evening as a capital time for preparing a batch of dry plates A plain deal table, a chair or two, and a lamp or candle with a ruby shade or chimney, are all the furniture required Upon the table is placed a plate box with the requisite number of plates (cleaned preferably beforehand), the French chalk, a duster, and a pneumatic plate holder The stock emulsion bottle, a clean bottle for pouring, a funnel of glass or paper, and some cotton wool previously dipped in alcohol, must also be at hand. I will now describe the actual process of coating the plates.

Coating the Plates — Commence by shaking the emulsion thoroughly for, say, three minutes, and allow it to subside for ten minutes more. This done, filter two or three ounces through cotton wool into the pouring bottle, taking care not to allow air bubbles to remain so as to form subsequently on the plate Lay aside the filter, and place the pouring and stock bottles in juxtaposition. Now take one of the cleaned plates, and apply the French chalk or the indiarubber edging If a substratum of albumen or gelatine be preferred, it should have been applied previously. Attach the plate to the pneumatic plate holder, and pour on the emulsion

exactly as if it were collodion. Hold the lip of the pouring bottle near to the surface of the plate, in order to avoid air bubbles, and drain off the surplus emulsion *into the stock bottle.* Rock the plate gently to obviate crapiness, and when the film is set, rear the plate up against the wall or the side of a box to dry. Proceed as above with all the plates, always returning the surplus emulsion to the stock bottle, and not to the pourer, and filtering more emulsion as required. It is difficult to say the exact number of films which a given quantity of emulsion will produce. Perhaps twenty to twenty-four films of half plate size from every 2½oz. of emulsion is not very far from the mark. If the emulsion grows thick and flows with difficulty, a mixture of equal parts of alcohol and ether may be added at discretion. Before rearing up the plate to dry, the back should be wiped with a cloth, so as to remove the moist circular mark caused by the pneumatic plate holder.

Drying the Plates.—The final desiccation may be accomplished spontaneously, in a drying box, or by the aid of the contrivance suggested by Woodbury, and described in a previous chapter. We recommend the last of the three methods, from its simplicity and directness. Nothing can be easier than to lay a piece of sheet iron upon a support, to introduce beneath it a spirit lamp, to cover the surface with blotting paper of two thicknesses, and on this to lay the plates. The films dry rapidly and evenly, and may then be transferred direct to the plate box for future use.

Keeping the Plates.—Dry plates prepared as above will keep capitally for about a month. Theoretically speaking, they ought, perhaps, to keep for ever, but in practice this is found to be a delusion and a snare. When the plates are to be kept a month or more before exposure, the films should be treated with a preservative, in a manner to be explained in a future chapter. For the present, it is enough to know that by simply pouring a filtered washed emulsion over a plate a film can be formed, which will keep at any rate long enough for all ordinary purposes. To those who can find it convenient to prepare a batch of plates at the beginning of a week, to expose them during it, and to develop them at the end of it, it is particularly recommended to follow the above process in all its simplicity.

Exposure.—Rules for the exposure of plates prepared with washed emulsion as above can hardly be laid down with any exactitude. Perhaps from one quarter to a half as long again as wet collodion under similar circumstances may more often than not be found correct. It is recommended to the operator, after preparing an emulsion and a batch of plates according to any given formula, to adopt the following mode of procedure, in order to gain reliable data with reference to the correct time

of exposure Take one plate in the dark slide and expose one quarter of it upon any given object This can be done by drawing up the shutter of the slide to a quarter of its full length. Expose, say, for ten seconds, now draw up the shutter another quarter, and expose for a further ten seconds Do the same with the remaining two quarters and develope Of course, the quarter of the plate which was exposed first will have been so for forty seconds, and the remaining quarters for thirty, twenty, and ten seconds respectively On development, it will easily be seen which has been the correct exposure, from the density or want of it apparent in the successive quarters This method can always be relied upon as providing a highly easy and speedy method of calculating the correct exposure for any batch of plates, provided, of course, that the latter are of uniform quality and sensitiveness

Development —The development of emulsion dry plates can be effected in a variety of ways (see Chap I.) The formula for making up, and the method of applying, the strong alkaline developer has already been described and explained Prior to its application the plate should be flowed with equal parts of methylated spirit and water, and then washed until all greasiness has disappeared A dish of glass or ebonite may be used with advantage to hold the plate during development. A very satisfactory developer is the following

ALKALINE DEVELOPER (1)

No 1	Pyrogallic acid	3grs
	Water	1oz
No 2	Bromide of potassium	15grs
	Water	1oz
No. 3	Carbonate of Ammonia	1dr
	Water	1oz

The plate is first moistened with the solution of methylated spirit and thoroughly washed An ounce of No 1 is then taken in the developing cup, and flowed once or twice over the film Before returning the pyro solution finally to the cup, drop into the latter one drop each of Nos 2 and 3. On returning the pyro to the cup, a perfect admixture will result. Now pour the mixture over the film and allow it to work for a few seconds If the picture appears rapidly, the operator may be sure that it has been over-exposed, and he should not hesitate to add more bromide before re-applying the developer. If the picture, on the other hand, comes out reluctantly or not at all, more ammonia may be added at discretion until adequate density be obtained. The advantage of the above developer is the latitude conferred by its employment. Its production of excellent results will be furthered by using the pyro solution very weak at first, and increasing its strength afterwards if necessary. One grain to two grains

of pyro to the ounce of water will generally be found sufficient to begin with, and the diminution in strength is certainly conducive to an improvement in the quality of the resultant negatives

For the carbonate of ammonia some operators prefer to employ liquor ammonia fortis (880), in the proportion of about twenty minims of the latter to thirty grains of the former Those who use carbonate of ammonia will find the plan recommended in Chap II, Part II convenient and efficacious

The pyrogallic acid solution should be freshly mixed, as it loses its strength by exposure to the air To lessen, however, the inconvenience of making up an aqueous solution almost every other day, some have adopted the plan of keeping a concentrated solution of the pyrogallic acid in alcohol (as in Col Stuart Wortley's strong alkaline developer), and mixing it with water in the due proportions as desired The best proportions of the pyrogallic acid to the alcohol are, perhaps, 96grs of the former to one ounce of the latter Methylated spirit may be used as the solvent It will be seen that the above is the precise proportion laid down in the formula for the strong alkaline developer To make up almost any other proportion, very slight calculation is necessary Ninety-six grains to the ounce are equal to twelve grains to the drachm, or one grain to every five minims Suppose at the beginning of a working day it be required to make up six ounces of pyro solution, in the proportion of two grains to the ounce, all that is necessary is to pour out one drachm of the alcoholic solution and add it to five ounces and seven drachms of water Give the mixture a shake, and it is ready for use

Here is another developer in which common soda plays an important part It follows the formula recommended by Mr Inskipp for his excellent rapid dry plates, which are prepared, I believe, by a method not very widely different to that detailed in the present chapter I can recommend the following developer to my readers as charmingly simple, inexpensive, and easy of manipulation Using it with Mr Inskipp's plates, I have found it, when coupled with acid pyro intensification, to give excellent results

ALKALINE DEVELOPER (2)

Common washing soda ..	1oz
Bromide of ammonium ..	25grs.
Strong liquor ammonia	½oz
Water ..	10oz.

After the preliminary application of the spirit and water, take enough in the developing cup to cover the plate, flow over two or three times and back into the cup; " then, with a strip of thin glass or card about ½in

wide, take up a little dry pyrogallic acid on the tip, about the bulk of a pea for a half plate, stir into the developer and apply again, the image will speedily appear and gradually gain strength Should the detail be slow in coming out or lack density, add a little more pyro As soon as the detail is all out, wash off and fix in weak hypo After well washing let it dry If not then intense enough, moisten it again (with water only this time), and proceed to intensify with the ordinary pyro and silver intensifier, when any amount of density can be easily obtained

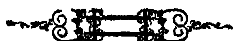
"The quantity of dry pyrogallic acid may seem rather indefinite, but considerable latitude is allowable Increasing the quantity quickens the development and produces density, and *vice versâ* Except for instantaneous exposures, it is better to add it gradually

"Do not attempt to get much density with the first developer The negatives are much better in quality if finished with the silver intensifier"

The details of development with the aid of ferrous oxalate have already been given (see Part II, Chap I, p 111), and need not be repeated From its simplicity and the cleanness and brilliancy of the resultant images, his developer will doubtless be a great favourite amongst our readers

Intensification —Although in alkaline development sufficient density can almost always be secured by the addition of ammonia, this plan is not always conducive to obtaining negatives of the highest quality Although in many cases the simpler method may be found perfectly satisfactory, it is better, as Mr. Inskipp, whom we quote above, observes, to give the finishing touch of density to the image by means of acid pyro and silver The alkaline developer should be used only to bring out the details When this is fully accomplished the plate may be washed and allowed to dry, or flooded with a one per cent aqueous solution of acetic acid The acid pyro intensifier may then proceed (in the former case after a second washing, in the latter directly) as in the wet collodion process

I will now proceed to give an account of two important and successful modifications of the above standard washed emulsion process, owing their existence to the respective efforts of Mr William Bedford and Mr Henry Cooper



CHAPTER V

FURTHER WASHED COLLODION EMULSIONS—MR W. BEDFORD'S PROCESS—MR HENRY COOPER'S PROCESS.

Mr W Bedford's Process —The following process, remarkable alike for its simplicity, freedom from spots, and general excellence, was described by the eminent landscape photographer, William Bedford, in the *British Journal of Photography* Almanac for 1878, from which we take the liberty of borrowing it in detail Mr Bedford takes as a basis for his process the recognised fact that in order to obtain plates as rapidly as possible, the emulsion should contain an excess of silver It is this principle which underlies the preparation of the washed emulsion described in the preceding chapter But the divergence of Mr Bedford's process from the beaten track is expressed in the following words, which are his own "It is generally recommended," he says, "to restrain the effect of this excess of free silver (which would otherwise inevitably produce a fogged and thin image) by adding acids to the emulsion before pouring it out to set, but it is often impossible, owing to the uncertain constitution of the various bromides used, to accurately determine beforehand the actual amount of silver nitrate which will be left in solution, and this leads to uncertainty in the composition of the resulting emulsion Another practical disadvantage of the presence of mineral acids during the formation of an emulsion is that they have the effect of producing the silver bromide in a state of division coarser than is the case if they are absent" Mr Bedford has, therefore, adopted the plan of omitting all acid from the collodion, simply taking care to have an excess of silver nitrate present The formula used may be identical (the nitric acid being quite excepted) with that prescribed in Chap IV, p 140 When the emulsion is properly formed, it is poured out to set in the ordinary way, and washed for two hours in two changes of distilled water. Mr Bedford next pours on "water containing 1 per cent of hydrochloric acid, which is allowed to act for four or five hours, by which time the whole of the remaining free silver will have been converted into chloride, and a trace of nitric acid

liberated, insuring perfect immunity from any disposition to fog, which will undoubtedly exist in the original emulsion. The action of the acid will, in all probability, have loosened the pellicle from the dish, so that, after being well washed, it may be doubled up and squeezed between folds of linen in a screw press, and finally dried on a water bath and re dissolved as usual A washed emulsion is thus produced which contains neither free silver nitrate nor soluble bromide (an excess of which is recommended by some emulsion workers), and after a comparatively short exposure in the camera, an image quickly appears under the action of plain pyrogallic acid, which may be easily developed to any requisite degree of density by the alkaline developer without the addition of organic matter of any kind "

Mr Bedford has made some experiments in the substitution of a 2 per cent. solution of calcium chloride for the dilute acid, with very encouraging results, promising increased rapidity Mr Bedford coincides with Captain Abney in the theory that silver chloride in an emulsion does not necessarily need acid as a restrainer I leave Mr Bedford's experiments to be continued by my readers, in the hope that they will thus mark their appreciation of the excellent process which he has presented with such lucidity and generosity to the photographic world

Mr Henry Cooper s Process —In the photographic exhibition of 1878 a conspicuous object of attention was a frame of exquisite landscapes contributed by Mr Henry Cooper. When it became known that these pictures were produced by a washed emulsion process embodying certain distinct departures from the *módus operandi* of the emulsions generally in vogue, a great desire was evinced to possess Mr Cooper's formulæ and method of work These Mr Cooper most liberally and completely made public in a paper read before the Photographic Society of Great Britain, and subsequently re-published in both the *Photographic News* and the *British Journal of Photography* From the two last sources I extract the following account of Mr Cooper's process I print the extracts in their integrity for reasons which I have given in previous quotations from Mr Cooper's contributions to photographic literature, namely, that that gentleman's own words are so clear and to the point that I should wrong them and him by attempting to twist them into my own —

"Prepare a stock collodion by dissolving 160gr. of pyroxyline (ordinary) in 10oz. of ether sp. gr ·730 and 6oz of good methylated alcohol Also make a solution of zinc bromide, in strong alcohol, 10gr to 1dr , and allow it to stand to settle for some time Much subsequent trouble is avoided by using only the clear portion of these two stock solutions

"To prepare 10oz. of the emulsion, take 5oz of the above plain collodion, place it in a 20oz or 30oz bottle, and add 1oz of the zinc

bromide solution and 20 minims of syrupy lactate of ammonia (to be obtained of Messrs Hopkin and Williams, of 16, Cross-street, Hatton-garden, E C, at 1s 4d per ounce Mr Cooper also procures his pyroxyline from the same dealers) Sensitise with 150gr of silver nitrate dissolved first in 80 minims of water, and then in 3oz of alcohol Add this in a boiling state to the bromised collodion, and wrap the bottle containing the emulsion in a cloth, to retain the heat as long as possible In twenty-four hours the mixture is sufficiently ripe, but a little extra sensitiveness may be gained by keeping it longer—say up to three days At the expiration of the maturing time add 20 minims of strong nitric acid, shake well, and pour out the emulsion to set As the evaporation of the solvents is to be carried further than usual, it is well, for this and other reasons, to spread it out sufficiently 5oz is quite enough for a 12in by 10in dish"

Mr Cooper lends the weight of his authority to the opinion that although precipitation of the emulsion to remove the superfluous nitrate salts has some advantages, it is only to be recommended when the finished emulsion can be rapidly used up His experience coincides with that of other workers in attributing bad keeping qualities to precipitated emulsions In connection with his formula, Mr Cooper goes on to remark that he attaches some importance to the extra percentage of alcohol which it contains, as, amongst other qualifications, it possesses that of facilitating the washing This last may be carried out in the ordinary way, and the pellicle when dry is to be dissolved in 5oz of absolute alcohol and 5oz of ether (720) If the emulsion does not flow properly, it may be improved by the addition of a little plain collodion, such as that of Thomas or Rouch

Mr Cooper adds as an appendix to the above method of preparing the emulsion that further experiments, made in consequence of suggestions in the *British Journal of Photography*, show that a marked increase of sensitiveness is obtained by reducing the proportion of plain collodion to one-half, the other quantities remaining the same If the finished emulsion flow too thinly, less than 10oz. of the mixed solvents should be used

Into the operations subsequent to the manufacture of the emulsion, Mr Cooper enters with some detail, and, as in these he introduces several points of novelty, we will give our readers the benefit of his experience In the first place, he recommends for the plates prepared by his process the substratum which was originally introduced by him some time previous to the reading of his paper before the Photographic Society of Great Britain, and which we have already promised to reproduce for our readers. The formula is as follows·

"Dissolve 60gr of Nelson's clear photographic gelatine in 10oz water, and add 2½gr chrome alum dissolved in a little water Stir well and filter, and keep warm Coat the plates whilst wet after cleaning, and rear up to dry in a light wooden box, the lower end of the plates resting on clean filtering paper, and only one top corner touching the side of the box To coat a dozen plates takes far less time than to wipe and polish them Before use they must be made thoroughly dry A good plan is to heat them and coat them as soon as cold"

Mr Cooper calls the above substratum the "insoluble gelatine," from the insolubility conferred on the gelatine by the addition of the chrome alum For the latter reason the solution must not be allowed to set and dry upon the measure or the funnel, as in that state it cannot be re-dissolved To the ease with which the substratum can be applied and to its efficiency I can bear personal testimony Mr Cooper proceeds

"When coated with the filtered emulsion, the plates must be immersed in water, and then treated with a strongly alkaline solution of albumen, either in a tray or on a levelling stand The albumen must remain in contact with the film for *not less* than a minute, when the plate is to be thoroughly washed, flowed with a 2gr solution of gallic acid, and dried in the usual manner

"A stock of the albumen may be prepared, as it will keep any length of time If Thomas's dried albumen be used, dissolve 20gr to each ounce of water, and add 20 minims of liquor ammoniæ fortis 880 If whites of eggs be used, add a few minims of acetic acid to them, in an hour or two strain, and to each ounce add 2oz of water and the above proportion of ammonia—that is, 1dr. to 1oz of albumen and two of water

"Commence the development with very weak pyro—½gr. to 1gr to the ounce—with one drop of a 10gr solution of ammonium bromide, and one drop of saturated solution of ammonia carbonate When all the details are out the negative may be finished with stronger pyro, but of all things *beware of getting too much intensity* Nothing is easier Thousands of plates have been spoiled by using too much pyro at the commencement of the development, and sometimes I wish it was very much more expensive to check its lavish use. Of course, in coaxing out detail on an under-exposed film, ammonia and bromide must be added at discretion.

"Use patience, and give the plate time, carefully screening it meanwhile from even the light of the dark room, and you will be rewarded by the possession of a tender, delicate image, brimful of details both in lights and shadows, having all the character of a first-rate albumen negative, and giving brilliant and artistic prints."

In the pleasurable enjoyment of this happy consummation, I leave Mr Cooper's process to my readers, merely repeating his caution that success can only be courted by a strict adhesion to the formulæ which it has taken him countless experiments to arrive at, and in which each step has been adopted as the result of his own experience or that of other leaders in the art of working emulsions



CHAPTER VI

PRESERVATIVES

BEFORE commencing a study of the following remarks on the preservatives in general use with collodion emulsions, I advise my readers to turn back and master, if they have not done so already, the judgment delivered respecting preservatives by Captain Abney, and given in Chap I of this book, p 105 This will teach the operator what a preservative ought to be I will now proceed to comment upon certain preservatives which experience has proved to be, if not perfect, at any rate effective, and which the reader may adopt without hesitation to his own practice until he shall have succeeded in discovering a better I have already found it necessary to give some formulæ for preservatives, for example, in the case of the bath plate processes, of Canon Beechey's unwashed emulsion process, and in the preceding chapter, in describing the washed emulsion process of Mr Henry Cooper I shall now be able, by giving the subject of preservatives the individual notice which it well deserves, to supplement these by one or two further formulæ, and at the same time to place the use and the practical management of preservatives upon a satisfactory and comprehensible footing even for the least quick-witted of my readers

In the first place a preservative can be applied to any washed emulsion It has already been noticed that plates coated with washed emulsion without a preservative will keep perfectly well for perhaps a month, but that after the lapse of that time their original qualities become sensibly impaired It is here, as in dealing with bath plates, that the preservative comes to the rescue, and confers on the plate keeping powers that may literally be said to be indefinite Besides this, the preservative almost, if not quite, invariably imparts a distinct quality upon the film treated with it at the proper period Let the operator prepare two plates by a washed emulsion process, exposing one without further treatment after the coating and drying, and the other after the application of any of the preservatives here or elsewhere formulated The difference in the results will be peculiarly apparent in the case of preservatives containing albumen,

the latter substance giving a minute delicacy of detail in the shadows which is by no means invariably to be observed in films guileless of its presence

The presence of a preservative also is a powerful preventive against "spots" The value of this qualification will be, if it has not already been, perceived by the operator when he encounters the phenomenon of "spots" in all its completeness I shall not now delay to examine the question of spots on emulsion plates, but will reserve it for future and more convenient discussion Uniformity of sensitiveness is another advantage conferred by the employment of preservatives, and one which will be greatly appreciated by those who get through a large number of plates in a short time

And now for some formulæ To begin with, I will repeat the formula, simple and excellent as it is, recommended by Canon Beechey in connection with his unwashed emulsion process Here it is

CANON BEECHEY'S PRESERVATIVE

Beer	1 pint
Pyrogallic acid ...	20grs

The beer should be fairly flat, not brisk The preservative should be filtered before use into a dish of porcelain, glass, or ebonite, and the plate immersed for one minute, as described in Chap IV of this Part A preliminary washing in water, until all greasiness has disappeared, should take place before the preservative is administered The latter operation can be performed either by flowing on or by immersion The plan suggested by Canon Beechey of having two dishes, one for water, the other for the preservative, and transferring the plates as coated, is strongly to be recommended, especially if the one who coats has an assistant

With the above preservative a substratum should be used—not French chalk, as it is hardly proof against the protracted washing or immersion, as the case may be The operator will find a solution of gelatine, 1gr to the ounce efficacious, or, perhaps better still, the substratum of insoluble gelatine, recommended by Mr Henry Cooper, and given in Chap V.

Another preservative, reminding us of a bath-plate process described in Chap II, p. 125, is the

TANNIN PRESERVATIVE

Tannin .. .	15gr
Water .	1oz

This can be applied like the beer and pyro, and for absolute simplicity is even to be preferred to it, though, perhaps, not for the fineness of colour and quality imparted to the negative

The coffee preservative, as described in Chap. II., p 113, in connection

with the coffee bath plate process, will also be found efficacious in dealing with emulsion plates

I shall not repeat Mr Cooper's preservative of alkaline albumen and gallic acid, as it is to be found in detail at the end of the preceding chapter

A very capital preservative indeed is the following, suggested by Colonel Stuart Wortley, the inventor of the "Uranium" rapid process It requires the preliminary application of a substratum, and also preliminary washing It may be used over and over again with occasional filtering, and the plates are preferably immersed in it

COL STUART WORTLEY'S PRESERVATIVE

STOCK SOLUTIONS

No 1	Salicine and water, a saturated solution	
No 2	Tannin	60grs
	Distilled water	1oz
No 3	Gallic acid	15grs
	Alcohol	1oz

To make up the preservative, the following proportions are observable

PROPORTIONS

No 1	2 oz
No 2	1 oz
No 3	½oz
Sugar	40 grs
Water	7 oz

Captain Abney, in an article in the *British Journal of Photography* Almanac for 1878, described a preservative of albumen and beer, which, he stated, gives excellent results as regards rapidity and delicacy of the image The emulsion is prepared in a manner similar to that prescribed in Chap IV, p 140, under the heading of a "Standard Washed Emulsion Process." For the preservative the following are prepared

CAPTAIN ABNEY'S PRESERVATIVE

No. 1	Dried albumen	25grs
	Water	1oz
	Liquor ammonia	½dr

Note —Instead of the dried albumen the white of one egg may be used

No 2	Ordinary bitter beer	1oz
No 3	Ordinary bitter beer	1oz
	Pyrogallic acid	1gr

The plate, after washing, is flowed over with equal parts of Nos 1 and 2, which are allowed to be in contact with the film for one minute It is then thoroughly washed, flowed over with No 3, and set up to dry

To develop these plates it is recommended to reduce the usual amount of pyrogallic acid to one third By this means a thin negative is

obtained, which can readily be intensified by the ordinary intensifier of acid pyro and silver In working plates treated with the above preservative, if the former are of large size, a substratum is required

Of the above preservatives it is difficult to say whether any single one is to be preferred to others One thing may be said, and that is that all the formulæ given are in the highest degree efficient Perhaps selection may advantageously be left to individual choice Beginners will probably become enamoured of the beer and pyrogallic acid preservative, and many will doubtless become so wedded to its simplicity and the charming quality it confers on the negatives that nothing will induce them to desert it in favour of more recent introductions Experience, on the other hand, not unfrequently has the result of making a favourite of a preservative in which albumen takes a prominent and representative part Detail in the shadows is a very desirable consummation, and this is exactly the quality that albumen is noted for conferring Again, tannin is not without its advantages, amongst which simplicity is not the least Lastly, if the operator suddenly discovers his chemical chest or laboratory to be wanting in any ingredient necessary to the composition of the more pretentious preservatives, he has but to make his way to the kitchen and to call in the humbler aid of coffee—aye, or of tea

Captain Abney, Mr Cooper, and other distinguished emulsion workers are agreed in the opinion that the practical value of emulsions is much enhanced by the use of a preservative A washed emulsion used without a preservative produces films which beyond a week or two are untrustworthy, besides being amenable to variety of sensitiveness and to "spots"

The preservative, as I have already noticed, obviates these imperfections, and surely the advantage thereby gained amply compensates the slight extra trouble of preparation and application Some day, perhaps, preservatives will be rendered wholly unnecessary by some startling innovation in emulsion work, indeed this consummation has already been reached in the gelatine processes shortly about to be described Until, however, the same immunity can be extended to collodion as to gelatine dry plates, the operator must be content to use preservatives and to be thankful Perhaps if in the present meteoric progress of photography we were content to exercise a little of the patience that so nobly distinguished Fox Talbot, Niépce, and Daguerre, we should hear a little less of "bogus" processes, of inventions which are but old friends decked out in questionably new-fashioned garb, and of failures which are but the natural outcome of ignorance, haste, and conceit



CHAPTER VII.

Appendix to Dry Collodion Processes

Before leaving the subject of dry plates prepared by the various dry collodion processes, and passing on to the processes in which the collodion is replaced by a solution of gelatine, there remain a few words still to be said These will relate partly to some few practical facts which the collodion emulsion worker may advantageously keep in mind, supplying his own conclusions where necessary or suitable, and partly to the defects and failures incident to the various operations of the respective processes In reviewing the latter it will be instructive for the reader to compare the difficulties of the dry collodion with those accruing to the "wet" It will be seen that in the first place the difficulties themselves have grown less numerous and less formidable, secondly that, while some of the old wet-plate defects are still apparent, there are in the dry collodion processes several novel eccentricities which require peculiar attention These will obtain brief, but it is hoped adequate, notice, at a later stage in the present chapter

About the difficulties attending the bath-plate processes little or nothing need be said It is not that the difficulties do not exist, but because they are identical either with those already mentioned in connection with wet collodion (see Part I Chaps VII and VIII) or with those occurring in emulsion work A good sample of collodion, a good sensitising bath, a good preservative—these are the *cruces* of the bath plate processes Any-one who has succeeded with wet plates ought to achieve the same result with bath plates The great qualification required by both is patience—patience in preparation, patience in exposure, and patience in development

Emulsion work is altogether different from wet and plate work The operator has to do everything for himself, even to prepare his own collodion, but it is easier nevertheless Apart from the convenience attached to collodion dry plates their preparation itself is really the easiest thing imaginable—that is to say, if it is entered upon properly and with the proper spirit One of the secrets of this facility is that in the dry

processes almost all the successive operations are entirely individual and distinct from one another In the wet process a plate is no sooner collodionised than it requires to be sensitised, no sooner sensitised than it requires to be exposed, no sooner exposed than it must be developed, and so on, while the quick continuity of operation has the further drawback that the slightest slip in the first step has a marked effect upon the last In dry collodion work each step may be separated by any length of time from its successor, and ample opportunity is allowed not only to render the respective steps secure, but to direct them in the right course if any of them—for accidents will occur—chance to stray The collodion can be made separately, and if it is faulty, can be doctored separately, so can the emulsion, the plates, and the developer These facts have the obvious and practical moral that with attention and care, the emulsion worker can do almost anything he likes with his tools, and if to these qualities he adds some deftness in manipulation, some thought, and some artistic skill, he need have no doubt but that photography will be to him literally "a thing of beauty and a joy for ever"

In emulsion work above all buy the best of chemicals Inferior alcohol, inferior ammonia both carbonate and liquor, and especially inferior pyrogallic acid, are much more easily procurable than the unsuspecting amateur would imagine But where the emulsion worker oftenest fails in the chemical line is in the pyroxyline. There are all sorts of pyroxyline in the market at all sorts of prices ranging from 1s. to 4s an ounce The price, by the way, must not by any means be always taken as a criterion of quality Mr Henry Cooper in his original account of his washed emulsion process with lactate of ammonia, remarks that the price of the pyroxyline used by him is only 1s the ounce Again, just as any special collodion is best when used with a sensitising bath prepared to a special formula, so special emulsion processes give the best results when in their preparation a special sample of pyroxyline has been employed This last fact has been noticed before in the instructions given as to the purchase of pyroxyline for the washed and unwashed emulsions respectively (see Chap II.) The importance, however, of procuring a sample of cotton which, if not specially adapted to, is at any rate suitable for any given process does not lose by being insisted upon For instance, a horny and contractile pyroxyline will give a film which will *peel*, or do its best to peel, from the surface of the plate—a defect only to be remedied by the troublesome operation of preparing an emulsion with a powdery pyroxyline and adding it to the contractile defaulter in order to produce the required mean

In emulsification (see Chap. IV., Part II) a smoother and finer grained emulsion, according to Captain Abney, is sometimes obtained by adding

the silver to half the given quantity of bromised collodion, and pouring in the other half subsequently

Instead of the turned bottle-case suggested in Chap IV as a satisfactory means of preserving emulsions from actinic light, a stone bottle—a ginger beer bottle, for instance—may be used with advantage Another plan, recommended for its simplicity, is to emulsify, ripen, and after pouring out to set, to wash, in a common jam pot

And now I will turn to the consideration of the defects of the dry collodion processes I will take first the old difficulty of *fog*, which I noticed at length in my treatment of the wet collodion process I may refer my readers to Part I, Chap. VIII, for some of the idiosyncracies of fog, but the practice of the emulsion processes necessarily brings forward fog—to use an Irishism—in several new lights For an excellent scientific disquisition on fog, reference may be made to pp 5-18 of Captain Abney's "Emulsion Processes in Photography"

Fog in the emulsion itself may be eliminated by adding, if the emulsion be an unwashed one, some drops of nitric acid, if a washed one, an adequate quantity of tincture of iodine The exact quantity can only be determined by experiment Plates which have been accidentally exposed to light "may be rendered ready for exposure by washing off any preservative they may have on them, and immersing them in a hock-coloured solution of potassium bichromate, or by water faintly tinged with potassium permanganate, or with a one-tenth per cent. solution of hydroxyl in water After washing, a preservative may again be applied" (Captain Abney)

Another method of deactinising exposed plates is described by Mr W Sherman, of Milwaukie, in the *British Journal of Photography* Almanac for 1877, pp. 112-113

Plates are sometimes fogged during development by the use of too powerful a developer The diminution of ammonia, or the increase of bromide, ought to cure this difficulty.

Crapiness in the film is generally due to the fact either that the solvents used in the emulsion are too aqueous, or that the emulsion has not been shaken up as directed before coating.

Round insensitive patches are to be met with in hot weather, when the mark left on the back of the plate by the pneumatic plate holder is not removed.

Blisters occur when too much gummy matter is present in the preservative.

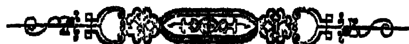
Drying marks are sometimes due to impure water having been used for washing the plate (in the bath plate and unwashed emulsion processes), or to the temperature used for desiccation having been too high.

Most of the other defects in dry collodion may be classed under the general head of "spots" Of these some may be easily explained, as for instance the thick specks caused by particles of dried emulsion which have coagulated round the mouth of the pouring bottle, slipping off on to the plate while coating About other kinds of spots, however, a vast amount of controversy has raged and the most ingenious theories have been advanced Probably the best explanation is to be found in the following words, which we extract *in extenso* from an article by Messrs Wratten and Wainwright in the *British Journal of Photography* Almanac for 1879 The long and successful experience which these gentlemen have had in connection with emulsion photography entitles their opinions to particular attention

"Undoubtedly there are more ways than one in which organic or other matter may come in contact with the film during the operation of coating and setting the film Particles of *dyed* material may drop from one's coat sleeve, for few think to give themselves a brush down before they go into the coating room, and dust may be raised by the careless manner of moving about the room, especially if it has not been laid with a wet mop Shelves, too, should be wiped down with a wet brush or *clean* wet cloth And the water used for 'swabbing' the floor should be *clean*, otherwise it will leave behind it a crop of dust for the future In fact, one cannot be too careful A blouse of unbleached holland is the best overall to wear in making plates, and not clothing of dyed material There is no doubt that what is termed 'unwashed' or crude emulsion would be equally liable to give spots of similar kind to the washed emulsion did not the action of the washing water immediately set the film in hard pellicle, and thus envelope the bromide of silver in an impenetrable casing"

This may, perhaps, account for the absence of spots in plates prepared with a washed emulsion and a preservative

"It must be borne in mind that until the ether and alcohol have evaporated from a plate coated with a washed emulsion, the film is in a soft and permeable state, and the feeble affinity which binds the bromine to the silver is insufficient to prevent a partial reaction when in that state it comes in contract with a suitable re-agent."



CHAPTER VIII.

THE GELATINO-BROMIDE PROCESS—INTRODUCTORY—NECESSARY APPARATUS, &c.

THE essential difference between the gelatino-bromide process and the various collodio-bromide processes detailed in the preceding chapter, is, as has already been pointed out, that in the former a solution of gelatine takes the place of collodion as a medium of suspension for the sensitive salts. Upon this fact hinge several important conclusions. The drawback of collodion emulsion is that, owing to its peculiar structure, the salts of silver can only with difficulty be introduced in a sufficiently minute state of division for practical purposes. This is a difficulty which the beginner in emulsion work will probably take some little time to completely master. In gelatine emulsion, on the contrary, this drawback almost entirely disappears. The peculiar feature of gelatine emulsion is that it holds the silver salts suspended in a very fine state of division indeed. In the first place this qualification should imply images of an extremely delicate character. A glance at a gelatine negative, or at a print from a gelatine negative, is amply sufficient to show what exquisite detail, even in the shadows, is obtainable by a process in which gelatine replaces gun-cotton, and water is an efficient substitute for the more expensive and volatile alcohol and ether. Again, it may reasonably be inferred that the minute state of division, in which the sensitive salts are suspended, conduces to increased rapidity of action. At any rate this theory is supported by facts. Gelatine plates have been and are being manufactured which are four, five, six, and under certain circumstances, ten and fifteen times as rapid as the best wet. A set of instantaneous views of the Oxford and Cambridge boat-race has been secured on such plates, while such objects as a train moving at fair speed, and races of all descriptions, are being taken on all sides with a by no means inordinate expenditure of labour or of time.

The extreme rapidity attainable by the employment of gelatine emulsions, renders it necessary to use the utmost precaution with reference to the light by which the plates are prepared and subsequently developed

In most cases gelatine plates are sensitive to the yellow rays, and consequently a common yellow light would be worse than useless Perhaps it is best for the gelatine worker to begin by having recourse to the most non-actinic media possible Two thicknesses of the deepest ruby, or, better still, one thickness of ruby in conjunction with one thickness of deep orange, ought to be sufficient Messrs Wratten and Wainwright, of 38, Great Queen-street, Long Acre, sell a deep orange paper, which, when steeped in boiled oil, gives a splendid light Two thicknesses of this will be found to screen the most sensitive plates from actinic light Some operators prefer to prepare and develop their plates at night, using a screened lamp or candle A candle shaded by ruby glass, provided there are no white reflections from the ceiling or elsewhere, may almost be said to be absolutely "safe" Before giving any formulæ let me sketch for the benefit of my readers a slight outline of the gelatino-bromide process in the form in which I shall first introduce it They will thus be able to gain a fair idea of the facility or difficulty of the process, and, moreover, to compare the various operations incident to it with those met with in processes already attempted

To begin with, I produce an emulsion by adding nitrate of silver to a bromised solution of gelatine In this emulsion there will consequently be formed bromide of silver and nitrate of ammonium, bromide of ammonium having been used to bromise the gelatine Just as in the collodion emulsion process it was necessary to eliminate the superfluous nitrate of zinc, it is now necessary to eliminate the superfluous nitrate of ammonium This is accomplished by allowing the emulsion to set, and afterwards washing the pellicle in a manner to be described in a future chapter But the point of the process lies in the period that ought to elapse between the formation of the emulsion and the allowing it to set into a pellicular mass The following words, borrowed from an authority in everything connected with gelatine, simply and tersely explain all on this point that needs explanation "By the addition of the nitrate of silver to the bromised gelatine an action termed 'double decomposition' is originated, in other words, an interchange of elements takes place between the two salts. If nitrate of silver were added to water containing bromide of ammonium in solution, an interchange of elements would instantly take place, insoluble bromide of silver would subside, and nitrate of ammonium would remain in solution. But gelatine, being a viscid medium, retards this chemical interchange, and therefore time must be given to bring it completely about. In order, therefore, to keep the gelatine in a liquid condition we place the bottle in water of 100° temperature, and it is found in practice that a period of from four to six hours will complete the double decomposition."

This prolonged "cooking" or "stewing," as it is familiarly called, is a point of very great importance, especially in reference to increased sensitiveness In some of the processes lately brought forward, and soon to be mentioned in these pages, the cooking is carried on for five or six days In these instances a very highly increased rapidity results from the prolongation of the cooking time, while by coating batches of plates at intervals during the number of days set apart for this purpose, plates can be obtained of varying degrees of sensitiveness It is advisable, however, in cases of very protracted cooking, to prevent undue decomposition of the gelatine by the addition to the emulsion of a small quantum of phenic, or, as it is more commonly called, carbolic acid

I will not enter at this moment into the preparation of plates, since that point will receive individual description, as in the case of plates prepared with collodion emulsions

I will now give a list of the articles necessary to the would-be worker in gelatine At the top of the list stands the gelatine itself Of gelatine there are many different kinds, manufactured by firms both English and foreign, and sold at a variety of prices I believe I am really benefiting my readers in recommending them to buy gelatine of some one approved manufacture, and to stick to it Most English operators use Nelson's No 1 photographic gelatine, which is a special make of very superior quality indeed This is sold at 6d the ounce, but readers are recommended to buy it by the half pound, which quantity should be purchaseable at 3s or 3s 6d The merit of Nelson's gelatine is that not only is it of standard quality, and sold at a moderate price, but also that it is obtainable through any chemist in any locality, however remote

The beginner should not be deluded into the idea that any sample of gelatine is applicable to photographic purposes This is a most decided fallacy For instance, Nelson's ordinary opaque gelatine, as sold by chemists and grocers, is worse than useless, for its employment involves both "red fog" and "frilling," two little difficulties which the gelatine worker soon learns to avoid by every means in his power

In addition to gelatine, one or two ounces of bromide of ammonium should be procured, and an adequate amount of silver nitrate These, with distilled water, comprise every necessary in the chemical line for the preparation of plates by the ordinary gelatine-bromide processes Some few others will be required in carrying out certain modifications lately introduced, but these will be reserved for separate notice

The development of gelatine plates may be carried on either by the alkaline or by the ferrous oxalate developer Both of these have already received mention, and nothing further remains to be submitted in con-

nection with them beyond the actual formulæ, which will be given in their proper place

In the way of apparatus but little will be required beyond bottles and a test tube or two in which to dissolve the silver prior to emulsification In washing there is a certain excellent method which was introduced to the public in 1878 by Messrs Wratten and Wainwright, and which requires some simple and easily manufactured apparatus, but this is another point which must be relegated to a succeeding chapter In preparing plates, a good sized sheet of plate glass and a levelling stand will be required Of course the size of the sheet of glass depends on the size and number of the plates to be coated Two or three small sheets of glass answer just as well as one big one, but they will each require a levelling stand unless some simpler contrivance be devised to replace it Levelling stands range in price from about 3s to 5s

In development, two or three ebonite trays, of one size larger than that of the plates to be developed, will be found of the utmost use and convenience Care should be taken to use these trays only for one specific purpose, such as development, fixing, and so on On no account should these operations be carried on indiscriminately in one and the same tray

I think I can hardly conclude the present chapter more satisfactorily than by summing up the various advantages of gelatino-bromide In the first place comes its undoubted excellence as regards results A comparison between a gelatine negative and a collodion negative is not by any means encouraging, for the colour and general appearance of the former is very much against it But a comparison between the prints taken from the two negatives respectively is quite another thing, and, in some cases, gelatine has been actually known to carry away the palm from a standard specimen of wet plate work The delicacy of details is a most important qualification, and, moreover, renders the gelatine process a peculiarly apt one for the production of transparencies both for enlarging and other purposes Then again the sensitiveness of gelatino-bromide is simply unrivalled Thirdly, its simplicity Under this head comes the fact of the fewness of chemicals required Fourthly, its cheapness Fifthly, it requires no substratum Sixthly, it needs no preservative All these are very palpable advantages, and not difficult to be appreciated, especially by beginners Of course there are counterbalancing disadvantages, but upon these I need not descant, at any rate at present We must be content to regard gelatino-bromide as an acceptable and serviceable gift horse, and the least we can do is to refrain from looking it in the mouth

CHAPTER IX.

A Standard Gelatino-Bromide Process

This process, which may well be called a standard one, follows substantially the formula and directions of Messrs Wratten and Wainwright, who themselves are extensive manufacturers of gelatino-bromide dry plates for the photographic market The process is a simple one, its excellence as regards results I will leave to my readers to demonstrate The following is the bare formula for what constitutes the first stage or stepping-stone in the process

Gelatino Bromide of Silver Emulsion.

Gelatine (Nelson's No 1 Photographic)	90grs
Ammonium bromide	45grs
Silver nitrate	75grs
Water (distilled)	5oz

The above are the proportions for 5oz of emulsion I would advise the beginner to commence by preparing, say, half the quantity, since 2½oz will coat a considerable number even of half plates, and, moreover, it is a pity to risk a waste of material in a first attempt For the sake of convenience, however, I will adhere to the quantity given If the reader wishes to prepare 2½oz instead of 5oz, he has but to halve all the proportions given

The operator should next choose a 20oz bottle, with a well-fitting stopper, for the obvious reason that unless the stopper be accurately ground, the loss of the bromide salt, which is the first of the constituents to be dissolved, will overthrow the balance of the proportion A wine bottle with a new and tightly fitting cork may be used, but a stoppered bottle is more convenient

Now pour into the bottle 4oz. of water, and dissolve therein the ammonium bromide This done, add the gelatine, and leave it to soak for one hour After this interval, dissolve in a bottle or test-tube the

silver nitrate in the ounce of water still remaining unused Retire to the dark room, and place both the bottle containing the swollen bromised gelatine and the vessel containing the silver nitrate solution into a bowl filled with water at 100° Fahrenheit

It may here be mentioned that a most useful, if not indispensable, piece of apparatus connected with the practice of gelatine processes is a thermometer for determining the temperature of water These can be bought of different sizes, and at prices ranging from about 2s 6d to 5s

The immersion of the two vessels in the hot water will have the double result of causing a rapid and thorough solution of the gelatine, and of equalising the temperature both of it and of the solution of silver nitrate Now mix the two in the larger vessel, either by slowly stirring the silver into the bromised gelatine or by adding it in small quantities, with a thorough shaking between each "Either method," say Messrs Wratten and Wainwright, "if *well done*, is efficient"

We have now a gelatino-bromide emulsion, such as it is, but something still remains to be done which is not only important but essential In the first place, it is necessary that the "double decomposition," or interchange of elements between the two salts of silver and ammonium respectively, which was alluded to in the last chapter, should be completed But gelatine, as before stated, being a viscid and not a limpid medium, the chemical interchange will take some little while At the same time, it is requisite to keep the gelatine in a liquid condition, and so—I am quoting freely, but not without conscience and good reason combined—"we place the bottle (containing the emulsion) in water of 100° temperature, and it is found in practice that a period of from four to six hours will complete the double decomposition

"If water of a higher temperature than 100° be employed, the interchange will be completed in a shorter space of time, as the gelatine, being thereby rendered more limpid, presents less obstacle But we must bear in mind that 100° is a safe temperature, and that a higher temperature can only be employed at a risk of decomposing the gelatine, the results of which would be inconvenient at the final stage of development—these results being blisters and frilling"

It may seem difficult to the uninitiated to keep the water in which the bottle of emulsion is placed at an even temperature of 100° for so long a period as six hours at a stretch , but this can be managed in a variety of ways, even when the period of digestion is extended to such apparently impossible limits as half a dozen days, instead of hours Some operators place the emulsion bottle in a fish-kettle or saucepan with a lid, and introduce beneath the latter a faint gas jet, adjusted so as to keep the water at the required temperature. But this plan has its drawbacks.

In the first place, it is difficult to keep the gas burning at an even jet. At night, for instance, when all the other burners in the house are at work, that upon which the fate of the emulsion depends, naturally dwindles down perceptibly until the moment when all the burners are turned off for the night, when it springs up and burns away perhaps even too merrily to be useful A second—and decidedly practical—objection to the adoption of gas is that in many houses, from choice or chance, it is not laid on A much better plan, and one which combines facility, inexpensiveness, and certainty, is the following Everyone has seen in many a shop window a species of toy paraffin lamp, which is supposed to be used instead of a night light They are, I believe, of American invention, and are known by the name of "Little Harry's Night Lamp" They will burn for about twelve or fourteen hours at a stretch, and, while producing a small illumination, give off for such tiny generators a considerable amount of heat One of these "Little Harry's Night Lamps," then, is procured, and it is found by experiment at what height from the flame an even temperature of any required number of degrees can be sustained Probably water could be kept at an even temperature of 100° at a height of about 7in or 8in from the flame In "cooking" gelatine emulsion, the water may be any temperature above 100° when it is first poured into the "cooking kettle" It can then be cooled down to 100°, the bottle of emulsion introduced, the lamp lit, and the kettle raised to the necessary height above the flame As regards the outlay necessary for this operation, it may be mentioned that the lamp burns a hundred hours at the cost of one penny, and can be bought for sixpence or eightpence, while the kettle may be borrowed from the kitchen, and the support to keep it at any given height from the flame may be home-made of thick wire, or bought for a few pence more

The digestion having been continued for a period of six hours, it now remains, prior to the actual coating of the plates, to eliminate from the emulsion the superfluous nitrate of ammonium This may be done in four different ways The first method is simply to decant the emulsion into a large bottle (say, a Winchester quart), and to revolve the bottle in the hands until the gelatine has set all round the sides A thin stream of water is now allowed to trickle into the bottle from a tap, or, preferably, from an indiarubber tube fastened to the tap and going down quite to the bottom of the bottle The dribble of the water should continue for at least eight hours.

The second method, due to Mr King, is dialysis as practised by chemists. The plan is efficient and scientific, but, as an authority very rightly remarks, tedious, and unlikely to come into general favour

The third method is one proposed a year or two back by Messrs Wratten and Wainwright, and consists in adding to the emulsion, for each ounce of water used, two ounces of alcohol (methylated spirit not containing gum may be used), and well shaking up the mixture "The gelatine rapidly assumes a pasty appearance and subsides to the bottom The bottle is then inverted, and the fluid, which contains the soluble nitrates and excess of water, is poured off, and preserved for distillation The explanation of the efficacy of this method is that the alcohol has a greater affinity for water than has the gelatine, and that in extracting the water the soluble salts are extracted with it The emulsion thus freed from soluble salts may be treated with warm water to cause it to re-dissolve, or it may be dried to the state of pellicle"

The fourth method is also due to Messrs Wratten and Wainwright, and may fairly be said to have superseded the others, at any rate, so far as general practicability goes Here are Messrs Wratten and Wainwright's own directions "Apparatus required (1) A bag made of that 'napless' canvas which ladies employ as a basis for Berlin wool-work, (2) a trough, say, 12in by 10in, and 10in deep, and fitted with tap to draw off the water, with a ledge around the inside, about 2in from the top, to support (3) a tray with wood sides and calico bottom

"Scrape up the gelatine with a strip of glass, and transfer it to the canvas bag, close the aperture of the bag, and, by the pressure of the thumb and fingers, force the gelatine through the meshes of the canvas into a basin of water We now have the gelatine in extremely fine division, but it is also mixed with a vast excess of water Now we pour the whole on to the tray with the calico bottom, and the water will pass off, leaving the gelatine high and dry In order that we may be sure that the proper amount of work is done, it is well to fill up the trough with a fresh supply of water and let the tray float upon it for ten minutes

"When the water has been finally drained off, we transfer the gelatine to a bottle, stand it in hot water, and when dissolved and filtered it is ready for coating the plates."

When the gelatinous pellicle has resumed its liquid condition the coating of the plates may forthwith be proceeded with If it is desirable to postpone this operation for any time, the bottle containing the emulsion may be placed *neck downwards* in a dilute solution of carbolic acid. This is a plan proposed and successfully carried out by Captain Roger Laurent Another method is one introduced and patented by Mr Kennett, of Maddox-street, himself an extensive manufacturer of gelatine plates. It consists in not allowing the set gelatinous mass to re-dissolve, but, on the contrary, spreading it on some such surface as canvas, and completely

desiccating it by the aid of heat When required for use, it is necessary to replace the water in the proportion, about 1oz to 50gr, of the dried pellicle Operators are free to adopt this method if they please, as the patent restriction no longer exists

Supposing the emulsion at last to be ready, and supposing it to be the operator's wish to proceed with the coating of the plates, the following precautions must be observed In the first place, of course, there must be a good non-actinic light, in the second, the coating room must, as already pointed out, be as free as possible from all suspicion of dust A stock of clean plates and a pneumatic plate holder also follow as a matter of course Besides these a sheet or sheets of accurately levelled plate glass must be at hand (see p 161) A spirit lamp, or, better still, a hot-water can or some kindred contrivance, will be necessary in order to warm the plates before coating Mr Woodbury's arrangement of a piece of sheet iron covered with blotting paper, and superposed over a spirit lamp, answers admirably

A glass plate is now taken on the pneumatic plate holder, and very slightly warmed to a temperature which the back of the hand can bear very comfortably An ounce or so of the warm emulsion is supposed to have been filtered through fine cambric into a clean glass measure, which should have previously been warmed by immersion in hot water or otherwise The filtered emulsion may now be poured in a round pool on to the middle of the plate, the latter being slightly rocked to allow the emulsion to spread to the edges The surplus liquid is allowed to drain back into the measure, and the plate is laid carefully down upon the levelled surface to set and subsequently to dry

The chief point in coating is to remember the great difference between an emulsion in which the silver salt is suspended in collodion and one in which the place of the collodion is taken by an aqueous solution of gelatine In the former the solvents are extremely volatile, and sufficient evaporation to leave a suitable film on draining takes place almost immediately On the other hand, in the actual process of coating this great volatility is inconvenient, for, as the collodion emulsion is exposed to air, it naturally loses some part of its solvents by evaporation, and unless further dilution is resorted to, eventually becomes too thick to be properly made use of Gelatine emulsion, whilst obviating this last inconvenience, is still liable to the one from which collodion emulsion is free It is extremely convenient to be able to retain the emulsion during coating in an open vessel by simply keeping the latter standing, when not in use, in hot water At the same time it is troublesome not to be able to dry the plates offhand, as can be easily accomplished with dry collodion processes Again, the insufficient volatility of water necessitates an important precaution to be

observed in coating gelatine dry plates It would be of no use whatever to simply flow the emulsion over the plate, and, after draining, to stand the latter up to dry It is necessary, on the contrary, to drain only partially, and to allow about three times as much emulsion to remain on the plate as would be left if the latter were drained in the same manner as in dry collodion processes The plate is now laid upon the levelled glass surface, in order that the chill may cause the liquid gelatine emulsion to set When this is done, the necessity for an accurately levelled surface is removed, and the plates may be allowed to rest, until desiccation is complete, upon a table or shelves in any darkened room

If it be imperative to dry the plates with the utmost possible rapidity, the following convenient plan recommended by Mr E W Foxlee, may be adopted When the films have been thoroughly set the plates may be immersed in a dish containing strong methylated spirit The alcohol in the course of four or five minutes will be found to have absorbed the water, and the plate, being removed, will consequently be completely desiccated in a few minutes, owing to the rapid evaporation of the alcohol now left on the film

The exposure of gelatine dry plates prepared by the above method will probably, in ordinary circumstances, be about the same as that requisite for wet plates It is advisable, however, to make a preliminary experiment, as advised in a previous chapter, by exposing separately four different portions of one plate upon the same object and under the same conditions of light, and developing as though only one exposure had been given

At this juncture I may well fall back again on Messrs Wratten and Wainwright's published instructions, which apply to the development, &c , of the exposed plates These are quoted in full, because they are lucid, practical, and, at the same time, very well worded and concise To begin with, the following is the formula for the

DEVELOPER

A	Pyrogallic acid	2grs	Freshly mixed.
	Water (ordinary)	1oz	
B	Bromide of potassium	15grs	
	Water	1oz	
C	Liquor ammonia	1dr	
	Water	1oz.	

"Lay the exposed plate in a dish in cold water (*hard*, not soft, water) for one minute, during which time pour into the developing cup 1oz of A Pour off the water and apply the A, leaving it also on the film for about one minute Now drop into the cup, say, three minims or drops each of B and C, return A from the plate to the cup, and perfect ad-

mixture will result Re-apply, and in about thirty seconds or so the image will begin to appear, and will gradually progress until the power of the developer is exhausted

"If it should come up rapidly with this small quantity of C, it is a sign of over-exposure, and more B must be added as quickly as possible If, on the other hand, no sign of the picture becomes manifest under its influence, the plate will have been undoubtedly under-exposed, and it will be advisable to add more C without any B In any case, more C should be required to complete development, or no density will be obtained From the foregoing, the learner will comprehend that A is the true developer, B the restrainer, and C the accelerator, and it must be his study so to employ them as to obtain the result he desires When the whole of the detail has been brought out, wash well, and then fix in a solution of

Hyposulphite of soda	4oz
Water	20oz

and wash again most thoroughly Should any tendency to frilling of edges be seen during development, it will be well to flood the film with a saturated solution of common alum in water before fixing, but the film must be well washed between the application of the alum and the fixing solution It cannot be too strongly urged that washing should be as copious as possible between each operation

"In cases where, from unavoidable over-exposure, it has been impossible to obtain density with the alkaline developer, a most careful washing should be given after fixing, with a view to remove the last trace of the alkali (ammonia)

"Intensification can then be effected with acid pyro and nitrate of silver, or with protosulphate of iron and nitrate of silver We have a decided preference for the latter, and we use the following formula, viz

A	Protosulphate of iron	15gr
	Gelatino-acetic acid solution (as described below)	40 drops.
	Water	1oz

The gelatino-acetic acid solution is compounded as under —

B.	Gelatine	15gr
	Acetic acid, glacial, 50°	3dr
	Water	5dr

and it is well to prepare a stock of this, and also of A, as they are both better for keeping.

"To proceed. First flood the plate with water, and then with a solution of iodine and iodide of potassium, of the colour of *pale* sherry, for

one minute, rinse it off, and apply enough of A to cover the plate for about the same time Now drop into the cup a drachm of B, and bring the A back from the plate to the cup to mix them together Re-apply, and keep moving over the surface until density is sufficient If any air bells should occur, they must be kept moving, and then they will do no harm

"Both development and intensification are best performed in a dish, the former in an ebonite, the latter in a porcelain

"When the plate has again become dry, warm and varnish it as usual"



CHAPTER X.

Miscellaneous Gelatino-Bromide Processes

Mr C Bennett's Process —The following is an account of an extremely rapid process introduced by Mr Charles Bennett, and described by him in the *British Journal of Photography* In it Mr Bennett has introduced various important deviations from the ordinary method of working the gelatine process, as detailed in the preceding chapter These deviations will be easily understood from the perusal of Mr Bennett's lucid instructions, and, it is to be hoped, adequately appreciated when from perusal the operator proceeds to practice The stringent insistance upon the necessity of an absolutely non-actinic light, the prolonged emulsification, and the unrestrained developer, are points which Mr Bennett, if he has not originated, at least deserves praise for having brought too forcibly before public consideration to permit of their further neglect

With regard to the light, Mr Bennett says he has tried "warranted non-actinic," and "tested by spectrum analysis" glass, and that he can print transparencies through two thicknesses of such in about 30min He therefore advises those who wish to follow out his process, to procure direct from a glass merchant some of the *darkest* shade of ruby, using two thicknesses for daylight and one for lantern By adopting this precaution, in spite of the extreme sensitiveness of the plate and the great power of the developer, operations may be carried on without any danger of fog By way of adding to the security given by the non actinic screen, Mr Bennett employs a ruby-coloured hock bottle to hold the emulsion during the "cooking" period With this at hand, supplemented by two 8oz decanter-shaped bottles, made of test-tube glass to stand heat, the following formula for 10oz of emulsion may be followed —

Ammonium bromide ..	70grs
Silver nitrate	110grs
Gelatine .	200grs
Distilled Water	6oz

The following instructions, upon the close adhesion to which Mr Bennett very correctly insists, are in that gentleman's own words "Use Nelson's No 1 photographic gelatine, for with the opaque sixpenny packets you have irregularity, red fog, and frilling Place aside 4oz of water for the bromide, and 2oz for the silver, dissolve the bromide with heat in one of the test bottles in 1½oz of water, pour into the hock bottle, swill out the test tube with the remainder of the 4oz set aside for the bromide, and also pour in I do it by heat, to insure all being dissolved, as it does so very slowly after the gelatine is inserted The 4oz of solution being now almost cold, add the gelatine, shake up well, and place in two or three gallons of water at 90° I use a fish kettle with lid In two hours the bromised gelatine will, after well shaking, be quite liquid, and also nearly at 90° Now dissolve the silver in the other test bottle by heat in 1oz of water, cool to 90°, and pour in, use the remainder of the 2oz set aside for the silver to swill out, heat to 90°, and pour in By being so particular, we get regularity, and are able to mix the plates of different batches, which is a great boon Shake the emulsion very briskly, and replace in the kettle for two, four, or seven days, according to rapidity required The temperature should never be over 90° If you do not let it exceed that you will not have red fog 'Cosy' it up with flannel, and it will not lower many degrees during the night"

Mr Bennett "cooks" his emulsion over a gas stove, but that this plan has its disadvantages has already been mentioned in the previous chapter The operator will find it difficult to beat the "Little Harry's Night Lamp" for convenience, cheapness, and efficiency

The emulsion may be shaken up every twelve hours. The longer it is "cooked" the more rapid and less dense it will be From two to four days' cooking will give very satisfactory results Beyond that time the exposure becomes almost unmanageable, except on dull days, and it further becomes necessary to resort to intensification, if anything approaching density be desired

Mr Bennett washes the emulsion by allowing it to set in a bottle not smaller than a Winchester quart, and washing for twelve hours by a dribble from a tap The bottle is wholly, with the exception of the lip, wrapped up in brown paper to exclude all light, and the water is conveyed to the pellicle by an indiarubber tube going quite to the bottom of the bottle. This is intended to stir away the layers of water, the specific gravity of which is greater than usual, owing to the salts with which they are now charged Some may prefer to adopt, in preference to this method, that advocated by Messrs Wratten and Wainwright, and previously described In either case, upon melting, you have eight or nine ounces

of emulsion, to this should be added ¾oz of pure alcohol heated to 90° The emulsion should be filled up to ten ounces with water, also heated The coating may proceed as described in the previous chapter

The following remarks relative to coating are valuable "The plates should only be lukewarm, or you will have red fog For beginners it much helps the coating to double the quantity of alcohol, leaving out water to that extent The operator should not be alarmed at the peculiar mottling of the film (due to the alcohol) directly after coating, this subsides, in a few seconds, to an even surface The extra alcohol does not appear to alter the sensitiveness, and is a great help, but with experienced workers it is not necessary, and the quantity mentioned above is sufficient to draw the emulsion up to the edges, which is the sole object of introducing it When no alcohol is used you always have *thin* edges, which is very objectionable, as the negative, of course, will print dark at those parts, and this small addition of alcohol totally rectifies this fault It is difficult to measure the exact quantity of emulsion required for each plate, one ounce would probably cover *eight* plates 6½in by 4¾in size"

No absolute limits for exposure can possibly be given As has already been mentioned, this depends greatly on the time allowed for emulsification, the actual sensitiveness of any particular batch must be determined by experiment

The development is best accomplished in a dish The plate is first soaked for a minute in ordinary cold water (not distilled), and is then treated with a developer compounded according to the following formula

DEVELOPER

Pyrogallic acid	1gr
Bromide	*none*
Liquor ammoniæ fortis	1 to 10 drops
Water	1oz

This is poured quickly along that side of the tray which is not occupied by the plate, and, by rocking the dish suddenly, is sent sweeping over the film The image is developed in from five to twenty seconds

The above developer, if applied exactly as laid down in the instructions given, ought to produce, providing the exposure has been correct, a dense negative with bare glass, representing the shadows, almost as soon as it has covered the film The quantity of ammonia should vary according to the light in which the picture is secured If the light be good, two, three, or four drops will be sufficient, if poor, a larger quantity will be requisite If much ammonia be used, and the plate be not developed in half a minute, the plate should be washed, and a fresh developer made up and applied.

Mr Bennett concludes the account of his process with some good hints as to ascertaining whether the light admitted to the dark room is of proper quality "Being now in possession of some extra-sensitive plates, put one in a thick book, and having placed it five or six inches from your ruby glass window or lantern, draw out the plate one-third for a few minutes, again draw it out further one third more for a short period You will then have the film in three divisions, as it were—one portion not having been exposed to the red light, and the other two portions having had different exposures Now develop, and use, say three drops of ammonia If your light be still at fault, the exposed portions of the plate will fog, in that case use another thickness of ruby glass" A variation of this plan, the dark slide taking the place of the book, has been recommended for ascertaining the requisite exposure of plates of uncertain sensitiveness

Plates, ready prepared according to Mr Bennett's formulæ, may be purchased of either the Liverpool Dry Plate Company, or of Messrs Samuel Fry and Co, Kingston on-Thames, S W

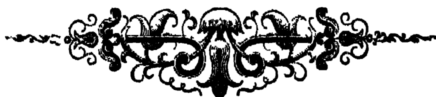
Captain Abney's Process—In the *British Journal of Photography* for 30th May, 1879, Captain Abney described the following process under the head of "A modified method of preparing gelatino-bromide emulsions" His account was prefaced by a few words, stating the object he had held in view, and the principles by which he had been guided whilst conducting his experiments His instructions, so far as the practical working of the process is concerned, are as follow "Let us suppose we want to prepare about 10oz of an emulsion with excess of silver, and that Bennett's formula is to be used Weigh out 70grs of (say) ammonium bromide, and add to it 1dr of nitric acid To fully convert the 70grs of bromide, we should require about 117grs of silver nitrate, so weigh out 130grs, and dissolve it in another 10oz of water Pour the former into the latter gradually, whilst so doing stir well, and then allow the precipitate to settle Pour off the supernatant fluid, fill up the vessel (a glass one by preference) containing the solution, stir well and again pour off Repeat this half a dozen times, or so long as blue litmus paper reddens in the decanted water When the paper remains unchanged, drain off as close as possible, and wait for the next operation

"Whilst this washing takes place the 200gr of gelatine can be put in to soak in a bottle containing 9oz of water, and, when swollen, a gentle heat is applied until it is dissolved The precipitated bromide is next spooned out into the gelatine solution, all particles being rinsed out with the warm solution The bottle is next shaken up vigorously, and the would-be emulsion will look perfectly hopeless, coarse particles of the silver compound being distributed throughout the liquid Place

the bottle for a quarter of an hour in a pan of water heated up to 90°, shake again, and pour out a drop on a glass plate It will be found that a perfect emulsion is formed—smooth and not very creamy Coat a plate with this for trial, and keep the emulsion stewing as in Bennett's process At the end of a day coat another plate, and stew again for another day, coat another plate, and so on as long as may be desired It will be found that each day's stewing improves the sensitiveness, and that the colour of the emulsion dropped on a plate, when examined by transmitted light, changes from a dirty yellow colour, when first prepared, to a grey violet after several days' emulsification Expose the trial plates, and note their increased rapidity as the cooking is prolonged One day's cooking or stewing will give one a decently rapid plate—as rapid, indeed, as a wet plate—and plenty of density"

Subsequently to the publication of the above instructions, Capt Abney recommended the addition of a little gelatine to the bromide solution, to remove granularity or grittiness of the film

Capt Abney states that in his experience of his process, a marked absence from "spots" has been noticeable He further adds that an emulsion free from all soluble salts can be prepared in a couple of hours, since, by increasing the temperature to 150°, an adequate creaminess and sensitiveness can be produced even in that short space of time



CHAPTER XI.

APPENDIX TO GELATINO-BROMIDE PROCESSES

THERE remains but little to be said in connection with the various gelatine processes beyond what has already been put forward in the three preceding chapters This little, however, although composed for the most part of seemingly unpretentious and fragmentary scraps of information, is actually of extreme importance to anyone desiring to become a really intelligent operator in gelatine It is given to few to acquire a sufficiently wide experience of any given subject, not only to render them thoroughly familiar with all possible contingencies, but also to place them in a position to build up new theories which time shall establish into practice One man at first meets with comparatively no difficulties at all, he is flattered at his perspicacity in choosing a process which suits him, and he resolves, perhaps wisely, to stick to it Another finds obstacles at every step, and throws up the whole concern in despair Both of these will profit even by running through the small talk of the present chapter The first will learn that difficulties do exist, which must be encountered, and will perhaps be secured against the dangerous habit of over confidence, that slippery virtue which so often at the approach of a possible failure melts away into cowardice The second, it is hoped, will undergo an exactly reverse operation He will, if he be wise, get it firmly fixed in his mind that failures are not really necessary, but for the most part, at any rate if due care and attention be given, as purely accidental as they were in the more elementary branches of the art If this is not enough to make him "turn to" once more with renewed vigilance and application, the sooner he bids farewell to all that is photographic the better for photography.

In the first place, it may create surprise that we have not made the

list of gelatino-bromide processes a great deal larger than it appears in the present work But this has been done advisedly If the account given in the present work is not long, it is comprehensive, and really includes about as much as can at present be safely put forward to the public by way of practical instruction There are other processes, it is true, which are at the moment being ventilated, but they are either in principle identical with those already discussed, while they do not supersede them in practical utility, or else they are hardly sufficiently established to be called existing processes Those who care to see the various methods of and modifications in working gelatine emulsions from time to time proposed by eager experimentalists, cannot do better than study the instructive pages of the two photographic journals, namely, the *Photographic News* and the *British Journal of Photography* Both of these journals publish yearly "almanacs," which teem with general information and accounts of new processes evolved from the brains of the best living photographers, as well as with concise and interesting *résumés* of photographic progress during the past year

As regards the operations incident to the manufacture of an emulsion, it need hardly be said that they should be kept as simple and as systematic as possible There are countless little dodges by which trouble may be saved in this respect without incurring the slightest risk of detriment to the result The dark room, as it is the centre or rather basis of operations, should be especially cared for, and the operator should take a reasonable pride in keeping everything in its proper place The reader may wonder why this trite injunction is once more urged upon him at so late a stage in the present work, but the fact is that it applies perhaps more accurately to the gelatine processes than to any others Simple and straightforward as he will find most of his work to be, the gelatine operator will be greatly at a loss if he does not give peculiar care to points of apparently minor importance In proportion as a gelatine film produces an image remarkable for its exquisitely delicate tracery and minuteness of detail, so is it affected by *contretemps* which, comparatively speaking, would have little or no effect on a film of robuster nature If not possessed of a drying box, the operator should take especial pains to avoid even a particle of dust in the room where the plates are drying, which is, perhaps, the period of all others when the work of preparation and coating is undone A "swabbing" with a wet cloth is a very good method of laying the dust previously to commencing work

It is advantageous for the beginner not to make up large quantities of emulsion at a time I would suggest 2½oz as a useful quantity to begin with, and for all experimental purposes. It is true that the formulæ given are for larger quantities; but this, I confess, is only for

personal convenience A very simple application of the rule of division will enable calculations for any quantity to be readily made up from the data given It may be added that, owing to the absence of evaporation, it is easier to make up small quantities of an emulsion the basis of which is an aqueous solution of gelatine than of one in which the volatile alcohol and ether are employed

In coating, if the plates are large and the emulsion cannot be brought to cover their surfaces readily, a glass rod may be used to assist the emulsion to the edges

As regards exposure, it has been already recommended that this be determined by experiment, by which means alone real accuracy can be obtained There is hardly anyone so rash, we venture to think, as to assert that accurate exposure is not productive of the best possible negatives, although we may not care to lay down the law that good, if not perfect negatives, may be obtained in cases where the exposure has not been exactly accurate At any rate, accurate exposure is the best of all bases for future operations, and the development of a well-timed negative is too good a treat to be constantly and carelessly forfeited

Beginners in gelatine will probably be surprised at the infinitesimal exposure in which, when using really rapid plates, a fully exposed negative is easily procured Practice alone will remedy the mistakes into which this extreme rapidity will beguile the unwary In cases where a second would be twice too long, and quarter of a second twice too short, the operator must look to the development to put him right

Relative to exposure, it is a curious fact that the rapidity of gelatine plates is by no means so greatly affected by inferiority of light as are plates prepared by collodion processes, wet or dry Gelatine plates are sensitive in no inconsiderable degree to yellow light, and on a day when, owing to preponderance of yellowness in the light available, a negative could not be taken by other means, one can be secured on a gelatine film with comparative ease One can see at a glance how the value of gelatine plates is enhanced by this fact, especially during the dull yellowy light of winter As a matter of fact, it may be said that gelatine plates, which in good light are three or four times as rapid as wet plates, are about twelve or fifteen times as rapid in light which is apparently bad for all plates alike

In respect of development, little can be said in supplement to the instructions already laid down, and the formulæ already given There are other formulæ, it is true, but none in my opinion which, for general simplicity, thorough reliability, and great latitude in use, are equal to the ordinary method of development with alkaline pyro The same remark

applies to the intensification with silver and pyro, or with silver and iron When it can be managed without inconvenience to the operator, it is recommended to develop very rapid plates at night, as then the light used can be rendered as non actinic as possible It requires no ordinary precautions to shield a really rapid gelatine plate from the bright light of a summer day, while it would be extremely difficult to fog one under ordinary circumstances with the light of a candle thoroughly screened by deep ruby glass

A strange fact in regard to fixation, brought before my notice by Mr Wratten, is that the weaker the fixing solution is the quicker the image seems to undergo fixation I confess I cannot account for this, but it is certainly to be regarded as a convenient freak of nature, for it materially diminishes the amount of washing necessitated by a fixing solution heavily charged with the hypo salt

Unless many proofs be required, the operator will not find immediate varnishing necessary before printing from gelatine plates The film is generally so smooth and hard that it may scarcely be scratched by the finger-nail

As regards one or two little difficulties connected with the use of gelatine plates Of spots I have already spoken, with such difficulties as fog and want of density I trust my readers are quite capable of grasping themselves If they have read and taken to mind the preceding chapters of this work, I think I may say that they have small excuse for being at a loss in this respect But there is one little annoyance connected with gelatine processes which cannot be dismissed so easily This is *frilling* Frilling is extremely easy to recognise when it does occur in practice, but it is not so easy to describe theoretically A well-frilled plate presents a most fantastic appearance Possibly there is a big blister in the middle of the film, or may be a variety of little blisters, but these are trifles compared to the edges, which are neatly puckered up in the quaintest and most exasperating manner imaginable It is in the summer months that frilling reigns especially rampant If soft or distilled water be used in soaking and development, frilling may be expected almost as a matter of course, a good deterrent, and one which is often effectual, is to drop into the water used for soaking and development a few grains of Epsom salts. Sometimes a soaking in methylated spirit will allay the disturbed surface of a frilled plate. But probably the best preventive is the following, which I quote in the words of a well-known operator and manufacturer of dry plates, both collodion and gelatine "The plan which I have myself adopted, and which I recommend to others, possesses the advantage of adding little or nothing to the trouble involved in developing

and finishing a plate, and may therefore be regularly adopted as a safeguard, even when frilling is not expected The method consists in immersing the plate, *previous to development*, in a solution of chrome alum of the strength of two grains to the ounce, instead of in plain water, and washing before the application of the developer Plates so treated lose nothing in sensitiveness, and show no trace of frilling and blistering, even under the most trying circumstances The application being made before development, the film is, of course, in a more favourable state to resist the action of an elevated temperature during the operation ''

With this I leave the gelatine processes in my readers' hands, confident that, if due care and attention be given by the latter, the former will repay their efforts at least as well as any of the processes here or elsewhere noticed and described



CHAPTER XII

Instantaneous Photography

The study of instantaneous photography is one which ought at some time or another to occupy the serious and, indeed, undivided attention of every photographer. The general end and aim of photography is the reproduction of nature, and one of the most marked characteristics of nature is motion. In some cases this motion is comparatively imperceptible, in others it is, to use an Irishism, about the only visible sign of presence exhibited. A child may make a reproduction of a post, but the difficulty of the task is sensibly increased when the post becomes a waving tree, a rippling stream, a tossing vessel, or any other of the thousand moving objects which daily meet our vision. The difficulty is a natural as well as a technical one. And it is this fact which leads us into an important and perhaps not over often indulged reflection concerning instantaneous effects. Let my readers imagine two pictures, both representations of the same subject, to be hanging before their eyes. Let us suppose the subject to be, say, a hunter or a racehorse in full career, and the representations of it to be respectively from the studio of a painter and from that of a photographer. Which of the two artists has, to use a vulgar expression, the "pull" over the other? As a matter of fact, unless the painter be one of no ordinary merit, the photographer may claim a decided advantage. By a timely loosening of a spring, or by some other kindred contrivance, he has secured an exact representation of a natural object not in an attitude of repose, but instinct with motion. The painter has, perhaps, produced a more artistic likeness, but the danger is great that, in the fleeting glimpse of his object, he has caught but a general impression, not unfrequently a faulty one, of postures and aspects in which minute detail and delicate accuracy are of even more importance than artistic distances, surroundings, tones, and what-not else besides. Instructive examples might be multiplied by thousands. A mother may take her baby to a painter, and expect, with a fair show of reason, to be furnished with a pleasing and generally

accurate likeness But to accomplish this not only takes much time and labour, but, owing to the natural fact that a baby's countenance rarely, except in sleep, retains the same expression for sixty seconds together, is fidgetty, uncertain work But take the baby to a good photographer, and after half an hour, by dint of coaxing the restless infant into a natural expression, and with the assistance of rapid plates and some method of instantaneous exposure, a real likeness is secured in a fraction of a second These random, and perhaps ill-chosen illustrations, are not in any way meant to convey an argument as to the invariable superiority of photography over, say, painting, as a means of reproducing instantaneous effects They are rather intended to hint that the distance between the two arts is less when dealing with motion than with repose In the latter case the painter has little trouble in attaining accuracy of reproduction as well as artistic effect, but when repose gives way to motion, there ensue natural changes, at any rate in living objects, which the surface of the "instantaneous" plate arrests with far greater promptitude and far less chance of error than the slow working pencil or tedious brush

Having thus briefly reviewed one feature of general utility which may well tempt the photographer to try his hand at instantaneous work, let me proceed to particularise a few cases where the force of circumstances not only limits but actually cripples the power imparted to an operator by the invariable adoption of a slow, however certain, process If the photographer be a portraitist, how often is he tortured by the apparition of the infallible and ever recurring baby? If he has a predilection for taking groups, has he never been pestered with the "fidget," who is always spoiling a picture and solemnly asseverating that he sat like a statue? Turning from portraits to landscapes, how many of the latter, it may well be asked, have lost all artistic effect by reason of moving trees, waves, clouds, and the like? And in how many days of our English year can these faults be rendered impossible of occurrence when a slow process is used? The mention of clouds is in itself a strong argument in favour of instantaneous photography, and one which should be obvious to a reader of Part I, Chapter XV, of the present work

Having demonstrated the utility if not the necessity of a means of instantaneously reproducing the semblance of moving objects, let me consider how the practical application of these means is to be managed. The first thought will naturally be for the process. A short time ago this would have been a far more serious matter for consideration than at the present When wet collodion was almost alone in the field it is true that instantaneous photographs of great merit were frequently

secured, but the task was one of difficulty and delicacy combined The process, never one of great simplicity, was further complicated by the necessity for extreme cleanliness, and for conditions of working which, to say the least, were tedious if not downright troublesome of attainment The chemical preparations had to be regulated to a certain pitch, and used after a certain period of preservation, while unless the light was particularly favourable, not even the utmost precautions, the most delicate skill, the most seasoned experience could guarantee a success Happily we may now congratulate ourselves that we have come to order things better in respect to instantaneous pictures, and that the latter are at last within the easy reach of operators, who, in the old days, would be looked upon as raw recruits, unskilled in the very goose-steps of the art The wet process has yielded, at any rate in this respect, to its many dry successors, we can even, so to speak, take instantaneous pictures by proxy, by the simple expedient of buying instantaneous plates ready prepared, of such startling sensitiveness and striking facility of manipulation, that photographs of the Oxford and Cambridge boats in full career, of a trotting horse, of an athlete jumping, of trains at almost full speed, of jostling crowds, and of nearly every other moving object, have almost ceased to be the envy of the unskilful and the marvel of the ignorant

As regards the actual choice of a process little need be said Instantaneous pictures can be taken both by the collodio-bromide and gelatino-bromide processes, but the facilities respectively afforded by them for this purpose can hardly be said to be equal To reproduce instantaneous effects by dry collodion requires nearly the same favourable conditions as those essential to the use of wet plates, for, as has been already pointed out, the dry plate worker must rest well satisfied with a batch of collodion dry plates, if their rapidity be even no greater than wet But with gelatine plates the matter stands very differently Instructions have been given in the previous chapters, by following which the humblest amateur can prepare for himself plates of almost indefinite sensitiveness Perhaps the beginner, if he desire to turn his attention to preparing instantaneous plates by the gelatine process may be well advised to call to his aid the formulæ and instructions of Mr Charles Bennett, or the modification of these introduced by Capt Abney, all of which are given in full in Chap X. If, however, the photographer objects to preparing his own plates, he will find every facility thrown in his way for purchasing them both of standard quality and at moderate expense.

As regards the working of instantaneous dry plates nothing need be added to the instructions given for the treatment of plates of ordinary

rapidity, and in connection with the Bennett process, which has been chosen as the type of instantaneous methods suited to the means of amateurs and beginners It need hardly be said that in special circumstances instantaneous pictures can be taken by ordinary processes by forcing the development, the quantity of bromide restrainer being diminished, or that of the ammonia being increased, but this is an expedient which should not be rashly or needlessly resorted to In the case of commercial instantaneous plates, full instructions are always sent out by the dealers supplying them, with the plates themselves

The means for instantaneous exposure usually consist of what are known as instantaneous shutters, which are manufactured in almost every conceivable form Their purpose is to leave the aperture of the lens uncovered for a fraction of a second, and to make sure that, except for this brief period, the lens is as well shielded as if an ordinary cap were used Means of effecting this purpose will readily suggest themselves to my readers after a very little thought If it be found that a shutter will not drop of its own weight with sufficient rapidity—supposing a "drop" shutter to be chosen for its simplicity—the help of india-rubber, or even watch springs, may be called in with advantage As regards commercial instantaneous shutters, the following remarks by an authority may be read with interest and attention "In reply to your question respecting the several instantaneous shutters in vogue, there can be no doubt that Mr England's form of shutter, viz, a guillotine drop immediately in front of the sensitive plate, is the best possible form of shutter, but it is cumbersome, somewhat difficult to apply, and requires great care in use to avoid dust, &c All instantaneous shutters applied in front of the lens act more or less as diaphragms Of those for very rapid exposures, perhaps the guillotine or drop shutter is the best The next, and what I believe to be the best shutter for quick exposures, is Mann's patent shutter, which opens and closes from the centre, but I must inform you that the slides being actuated by india-rubber springs, they are apt to get out of order The next best shutter I know of—perhaps *the* best, but not so rapid as the former—is Window's roller shutter The only objection to this form is its bulk After that I would class flap shutters of various descriptions" In spite of the concluding dictum, I would recommend the pattern of flap shutter introduced and sold by Mr. Rouch, of Norfolk-street, Strand, as being neat, effective, and as serving, moreover, as a sunshade for the lens. A shutter introduced by Mr. Weaver is being advertised by Werge, of Berners-street, the low price of which (7s 6d.) is a recommendation.

Messrs Wratten and Wainwright have introduced a new instantaneous camera. This is a double camera, one of which serves as a finder of

means of ascertaining the moment when a moving object is most satisfactorily posed and placed When this is ascertained a string is pulled actuating a shutter, which instantaneously exposes the plate in the other camera

As regards the lenses suitable for instantaneous work, this is a point which, in these days of extremely rapid plates, is not of anything like such importance as in the old times of wet collodion For portraiture any decent portrait lens answers, for groups and landscapes the rapid rectilinear, rapid symmetrical, portable symmetrical, and stereoscopic lenses of Dallmeyer and Ross, respectively, will be found quite equal to any occasion when using really instantaneous plates

In conclusion, I would wish it to be understood that the stress laid upon the desirability of instantaneous work implies any advice as to the invariable employment of instantaneous plates At the same time I think that they might be used far oftener than they are with good results, and I am sure that the trifling extra trouble involved would be amply compensated by the sense of ability to catch that poetry of motion which lives, and breathes, and has its being in every fibre and vein of natural life



CHAPTER XIII

Dealers in Dry Plates

In closing that portion of the present series which is devoted to the exposition and illustration of dry-plate photography, I think I cannot do better than give a list of the manufacturers of dry plates The demand for commercial, or "ready-made," dry plates is something enormous, one firm alone turning out from six to nine thousand dozen of plates of all sizes in a week, and even this supply is inadequate to meet the demands of customers

The names of most of these firms, their addresses, and their specialities, together with their prices, are given categorically I do not enter upon the relative merits of these makers, for that would be a task alike invidious and impracticable All may be recommended for doing their best to send out plates which may be relied upon as possessing the various qualifications claimed in the advertisements of the makers themselves As regards the advisability of amateurs procuring their plates, &c, from commercial sources, this must be left to their own discretion If the photographer can turn out a good emulsion and a good batch of plates, let him by all means depend upon himself He will find home made plates, if really well prepared, quite as good as and necessarily cheaper than commercial ones The processes thrown open to the public will be found in every way as certain, as simple, and as productive of good results as those in which "trade secrets" are involved Above all, the satisfaction attached to a picture obtained by the aid of an emulsion prepared by the operator himself from the beginning is hardly to be equalled with that accruing to pictures in the excellence of which a commercial dry-plate manufacturer can claim to have the least share But apart from all this, if the operator, by force of circumstances, by want of skill, or from any other reason finds himself unable to produce reliable plates at home, by all means let him consult the following, or any other list, and if he finds his choice of any particular make a really satisfactory one, let him adhere to it.

The following list is merely a catalogue collated from various sources for the benefit of intending purchasers, and that the names of the various firms and dealers are arranged indiscriminately and with no bias or preference

The Liverpool Dry-plate Company, St John's Hill, Clapham Junction (manager, Mr Peter Mawdsley), dealers in collodion emulsion and in gelatine dry plates Prices Emulsion, ordinary or instantaneous, 5s 6d per 5oz, gelatine dry plates, ¼ size, 3s 6d per dozen, larger sizes at proportionate prices

Mawson and Swan, Mosley-street, Newcastle-on-Tyne, dealers in "Swan's" plates, ten times as sensitive as wet Prices ¼ size, 3s per dozen London agent, J Werge, 11A, Berners street, W

Murray and Heath, 69, Jermyn street, London, S W, dealers in Ritchie's Patent Arabin Bromide of Silver Emulsion Prices 2oz bottles, 4s 3d, 5oz, 10s

Marion and Co, 22 and 23, Soho-square, London, W, dealers in "Britannia" dry plates List and particulars on application

W W Rouch and Co, 180, Strand, W C, dealers in collodion, emulsion, and dry plates, "Beechey" process, also in rapid gelatine dry plates Prices Beechey emulsion, 5s per 5oz, Beechey plates, ¼ size, 4s per dozen, gelatine plates, ¼ size, 3s per dozen

Wratten and Wainwright, 38, Great Queen-street, Long Acre, W C, dealers in collodion emulsion and "London" gelatine dry plates Prices Collodion emulsion, ordinary and instantaneous, 5s 6d per 5oz, gelatine plates, instantaneous, ¼ size, 3s per dozen, ordinary, 2s 6d per dozen

Samuel Fry and Co, Kingston-on-Thames, S W, dealers in "Kingston" gelatine dry plates Prices ¼ size, 3s per dozen

R Kennett, Maddox-street, Regent-street, W, maker of gelatine, pellicle, and dry plates Prices Pellicle sufficient for 5oz, 3s 6d plates, instantaneous, ordinary, slow, and slowed, ¼ size, 3s 6d per dozen

W H and J Nelson, Fielding House, Holly-road, Twickenham, S W, dealers in rapid gelatine plates Prices ¼ size, 3s per dozen

Fallowfield and Thomson, 15, Jelf-road, Brixton, S W, dealers in "Eclipse" dry plates. Prices ¼ size, 2s 6d per dozen

Smith, Boffinger, and Co, 222, Old Kent-road, London, S E, dealers in "Berlin" instantaneous gelatine bromide dry plates. Prices ¼ size, 2s. 6d per dozen.

D. H. Cussons and Co, 6, Gloucester-road, Southport, dealers in rapid and extra rapid Bromo-gelatine plates. Prices ¼ size, 3s. per dozen

C. E. Elliott, 36, Jewin-street, London, E.C., dealer in "Victoria" gelatine plates Prices: ¼ size, 3s. per dozen

W J Wilson, 2, Westwick Gardens, Hammersmith, W, dealer in extra rapid gelatine emulsion Prices 5oz, 4s 6d, 10oz, 8s 6d, pint, 16s

John Bishop and Co, 24, High Holborn, W C, dealers in "Holborn" and other gelatino-bromide dry plates

J F Shew and Co, 89, Newman-street, London, dealers in "Standard" gelatine plates Sample packet, containing four ¼ plates and directions, post free for 12 stamps

H J Inskipp, photographer, Tunbridge Wells, dealer in collodio-bromide of zinc emulsion and pellicle Prices Pellicle, 3s 6d per packet post free, sufficient for 5oz, emulsion, 4s for 5oz, 15s per pint

E Clennett, Sunderland-street, West Hartlepool, dealer in improved rapid and instantaneous gelatine plates Prices ¼ size, 2s 6d per dozen

J M Turnbull, 2, Hanover-street, Edinburgh, dealer in gelatine and collodion emulsion, also in "Waverley" gelatine plates Prices Gelatine emulsion, 5oz, free to any address, 3s 3d, collodion emulsion, 5oz, free, 4s, plates, ¼ size, 3s per dozen

A J Jarman, 41, Queen-street, Ramsgate, Kent, dealer in gelatine dry plates Prices ¼ size, 2s 6d per dozen

W Carsley, 18, Bartholomew-close, London, E C, agent for Leethem's gelatino-bromide dry plates and emulsion Prices Emulsion, 6s 6d per half pint, 10s per pint, plates, ¼ size, 2s 3d

With this list I conclude the second part of "Practical Photography"



PART III.

PHOTOGRAPHIC MISCELLANEA.

CHAPTER I

INTRODUCTORY

THE present chapter, the first of the Third Part of "Practical Photography," is also the first of a series relating to the art-science in entirely novel aspects It presupposes that the reader has taken to mind the lessons which the two previous parts were intended to convey, in other words, that he has arrived at that most important of stages in the study and practice of photography, namely, the ability to produce a negative What I am now about to teach him is a distinct advance upon this In this and following chapters I purpose showing both what may be done with a negative, and how the taking of a negative may be accomplished without the aid of those conditions which, to the beginner, would reasonably seem indispensable In the First Part of "Practical Photography," I gave instructions for printing from the negative upon paper sensitised with silver This process, delicate and excellent so far as immediate results were concerned, was still attended with one grave defect The results were fugitive, liable to fade away by lapse of time into mere shadows of their former selves I am now about to introduce my readers to printing processes which are permanent, and which in point of results bear favourable comparison with the best of silver printing Nay, more, I shall give an account of photo-mechanical processes by which prints can be produced without even the aid of light, and with a rapidity by the side of which sun printing falls into the shade Again, I have still further attractions to add to my programme I have reserved until now the various means by which photographic transparencies are obtained, and by which the tiny minia-

ture may be enlarged to the most imposing and effective dimensions I have also in store for the attentive and intelligent reader an account of several most feasible methods for producing negatives by artificial light But I must not forestall too much In a word, the present part of the series is to be a compendium of photographic miscellanies, such a compendium as I believe does not exist elsewhere in a form at once comprehensive, collected, and concise With this brief introduction, I will now proceed to the actual task which I have set before myself, merely premising that I shall not repeat the instructions given in the former parts of the series in reference to such points as preparing or procuring emulsions, dry-plates, and the like As I have already remarked, it will be assumed that the reader has at least read the first two parts of "Practical Photography," or else some work containing similar information If he has not, the following chapters may be interesting to him, but can be of little practical use I may mention that "Practical Photography," Parts I and II, have been reprinted separately, and may be procured at *The Bazaar* office, price 1s each Part I. contains a full account of the wet collodion process, together with printing in silver on albumenised paper, Part II is a manual—I believe the fullest and most practical ever published—of dry-plate photography



CHAPTER II.

THE CARBON PROCESS

THE first miscellaneous photographic operation of which I shall speak to my readers is what is called the carbon process, for producing photographic prints in permanent colour This process is also known by the name of Autotype, and is, on account of the permanence of its results much practised commercially, both in Great Britain and on the Continent There are several patents connected with its practice, which have been, or are at this moment, in the hands of the Autotype Company, of 36, Rathbone-place, London, W The patents now in force govern what is known as the autotype or carbon process by double transfer, and the position of the public with regard to them will be fully explained when dealing with that portion of our subject Before, however, entering upon any practical details, a few words must be said in reference to the Autotype Company itself This is a great commercial establishment, which is devoted both to the production of autotype prints for illustrated works, &c , and to the supply of all kinds of materials connected with the working of the process by others Up to the expiry, which took place a short time ago, of the patent governing that part of the autotype process known as single transfer, and also the manufacture of the carbon *tissue*, the Autotype Company possessed the monopoly of supplying the *tissue*, which is the most important element of autotype printing On the expiry of this patent, however, they threw open to the public the option of buying their tissue wherever they pleased Whilst this disinterested action on their part has given an undoubted impulse to the progress of carbon printing, at the same time the experience of the Autotype Company, and the facilities and improvements which they have introduced in the manufacture of tissue, are such as to cause little doubt that their circle of customers will remain undiminished by the ceding of their monopoly As a fit pendant to the above few words, which I considered necessary, if only to explain the position of the Autotype Company with reference to the process of which they are the fountain-head, I am

pleased to be able, unhesitatingly and without reservation, to recommend my readers to procure all their materials for the carbon process from the Autotype Company direct I feel certain that they will as little regret having followed my unusually strong recommendation as I, on my part, shall regret having made it

It is not my intention to go at all into the history of carbon printing, as that does not lie within the scope of the present work Those who wish to learn the steps by which the process has arrived at its present perfection may be referred to the "Autotype Manual," published by the Autotype Company, price 1s This excellent and practical little work is due to Mr J R Sawyer, the manager of the Autotype Company, and the patentee of the flexible support, which will be spoken of hereafter in connection with the double transfer process To its admirable arrangement and lucid explanation I am indebted for much of the present account There is another work on carbon printing which is published by Messrs Low, Marston, and Co, of 188, Fleet-street, E C This is written by a well-known German photographer, Dr Paul Liesegang, and translated into English by Mr R B Marston It is copiously illustrated with woodcuts, and may be had post free from the publishers for 4s

And now let me show my readers what carbon printing really is I have already described it as a process of printing in permanent colours, but this gives little idea either of its capacities or operation It is founded on the action of light upon bichromates, particularly those of potass and ammonia, in conjunction with organic matter—such as, for instance, gelatine As this may seem a little unintelligible to some of my readers, I will illustrate my meaning with an example If I take a sheet of gelatine and steep it in a bichromate of potass solution and then expose it to the light, what will be the result? The sheet of gelatine which before exposure to the light was soluble is now the reverse It follows that if, in exposing the sensitive gelatine sheet to the light, I superpose an ordinary negative, the dense portions in the negative will be represented in the gelatine sheet by portions which, not having been acted on by the light, are still soluble, while the transparent or semi-transparent parts are represented by corresponding insoluble portions of gelatine. If I now place the exposed sheet of gelatine in hot water the soluble portions will be washed out, and the insoluble will remain, forming, in other words, a species of engraved sheet, in which the densities of the negative, that is to say, the high lights in nature, are represented by the reliefs, and *vice versâ*. These results form the general foundation of both the autotype and the photo-mechanical processes which will be noticed in due course In carbon printing the gelatine is mixed with some pigment of the desired colour ground to a powder, and

spread upon paper of suitable texture This is called in England tissue The pigmented tissue is sensitised with bichromate of potass, and exposed to light under the negative The latent image is then developed with hot water and finally transferred to a white or tinted paper, which serves as its support There are two methods of transference which I have already alluded to under their respective names of single and double transfer These will be explained separately, for the present it is enough to say that the preliminary operations up to the exposure of the tissue under the negative are identical

The Tissue—I shall not discuss the manufacture of pigmented tissue, as in my opinion it would be a waste of space to do so Pigmented tissue is an article of very extensive commerce, and is sold of standard quality, and of almost every conceivable shade, by the Autotype Company and other firms It is sold by the Autotype Company in bands, 30in wide, and 15ft long, the price being 7s 6d per band Different shades are used for different subjects, and as the beginner in all probability is unaware of the latitude possible in this respect, I give the following list of shades from the Autotype Company's "Manual"

For enlargements and large pictures generally—the *Autotype Purple* or *Autotype Brown*—These colours have for their basis a pure black pigment, modified to a brown or purple tone by permanent blue or red

For engravings—*Engraving Black*—A pure black tissue

For monochromes—*Warm Black*—The black pigment of the preceding colour modified with permanent red

For sepia drawings—*Sepia Tissue*—A preparation exactly resembling the colour of a warm sepia drawing

For red chalk drawings—*Red Chalk Tissue*—As its name implies, a tissue matching a red chalk drawing

For portraits—*Portrait Brown* or *Portrait Purple*

For transparencies, especially intended for the reproduction of negatives—the *Autotype Transparency Tissue*—This is made with filtered colour, shows no grain or texture even when enlarged to 10 or 12 diameters, and is perfect for the production of enlarged negatives

The printer having procured, say, half a band of tissue of a suitable shade for his purpose, should then proceed to cut it up into conveniently sized pieces Many methods of accomplishing this simple operation will readily present themselves The tissue when cut should be stored away in such a manner that when about to be sensitised it should be tolerably flat. This result may be secured by keeping the sheets between metal plates and superposing a sufficiently heavy weight

And now I come to the actual operations by which carbon prints are produced. These are (1) sensitising the tissue, (2) exposure of the

tissue under the negative, (3) development of the latent image (4) transference of the image to the final support, (5) concluding operations In describing these I shall adopt the following arrangements To begin with, the two preliminary operations of sensitising and printing will be described consecutively Then will come "Development, &c, Single Transfer," "Development, &c, Double Transfer," and lastly the concluding operations which are common to both single and double transfer To these will be added a few lines of supplement, describing some of the miscellaneous applications of autotype printing

Sensitising —To sensitise carbon tissue it is necessary in the first place to have, as in sensitising albumenised paper with silver, a room adequately screened from the ingress of actinic light As the tissue when sensitised is not much more sensitive than good silvered paper, this requirement will be amply met by a yellow blind It is advisable to have as large a window as possible, for the successive operations in the carbon process require considerable attention, and there is nothing whatever to be gained by cooping oneself up in a really dark room It is as well, if possible, to set aside a room exclusively for the practice of the carbon process, in which not only the operation of sensitising but also that of development may be carried on It need not be very large, but it should most certainly be dry, having an ordinary stove, a tap and a sink for development, and a common deal table for cutting up the tissue and transfer paper, sensitising, &c There are a variety of ways by which an ordinary room may be adapted to this purpose, which will readily suggest themselves

As regards the apparatus requisite for the operation at present under review, namely, that of sensitising, it will be as well to give a list of the indispensable articles before proceeding to describe their application In the first place there is the dish to contain the sensitising solution This may be of tin or zinc, and should be about 2in larger each way than the largest piece of paper to be sensitised As it will have to contain about 2in of the solution, it may be made about 3in deep Besides this, the operator should procure another dish or tray of the same material, only 2in larger each way than the first Accompanying this should be a wooden stool or table to stand about an inch out over the top of it, the dimensions of this may be about 12in by 10in In addition to the two trays and the stool, a squeegee must be procured, also a broad camel's hair brush, an egg boiler, a glass plate of the same superficial dimensions as the larger tray, some sheets of common cardboard larger than the sheets of tissue to be sensitised, and finally some red blotting paper

A squeegee, as applied to the carbon process, is a strip of indiarubber let into a piece of wood, which serves for a handle One to answer the purpose of an amateur, who does not, as a rule, sensitise pieces of tissue

of very large dimensions, can be bought for half-a-crown The amateur is advised to spend this sum in preference to making the squeegee himself, as he can save but little by the latter course, and the squeegee is in such constant need that, unless well made, it soon becomes practically useless

The formula for the sensitising bath is charmingly simple Here it is —

BICHROMATE SENSITISING BATH

Pure granulated bichromate of potash	15oz
Water	2gals

Mr Sawyer, in the "Autotype Manual," directs this to be made up in a two gallon earthenware jug, with a piece of muslin tied loosely over the mouth, so as to form a shallow bag The bichromate of potash is put into this, and as much hot water as the jug will hold, or as much as will reach the bichromate salt if it should not all happen to dissolve when you pour hot water over it, the whole is allowed to cool and, when perfectly cold, is ready for use

Bichromate of potash is very cheap, costing about 2d per oz The Autotype Company, we believe, send it out in small bottles, of guaranteed purity, for the special use of those practising their process

Before beginning to sensitise, it is a needful precaution to put an india-rubber finger-stall on the first finger and thumb of each hand The reason for this is, that many, if not most people, are subject to what is known as bichromate poisoning, that is to say, the bichromate solution makes its way through the pores of the skin, and causes considerable pain, besides being productive of other disagreeable results Another method besides the finger stalls, which has been suggested as a preventive of this bichromate poisoning, is to dip the first finger and thumb of each hand into a solution of indiarubber in benzole, and allow them to dry Personally I prefer the finger-stalls

And now for the actual sensitising Place the smaller of the zinc dishes on the table, and fill it to the depth of 2in with the sensitising solution In close juxtaposition to this place the larger dish with the wooden stool standing inside it On the wooden stool lay the sheet of glass Have the squeegee ready to hand, and the egg boiler immediately in front of you.

Now take one of the pieces of tissue, pigmented side downwards, by the extreme ends, between the finger and thumb of each hand, bring the hands together as if about to fold the tissue; lower the tissue until the centre of the pigmented surface just touches the solution, bring down the ends gradually, until the whole pigmented surface floats on the bath, and push the piece of tissue bodily into the bath with the camel's hair brush. Carefully remove, with the brush, all air-bubbles from the back

of the tissue, and then, turning the tissue over, do the same for the pigmented surface By this time the sand in the egg boiler, which should have been set going on the immersion of the tissue, will have nearly, if not quite, run out When it has done so, lift the tissue slowly out of the bath by the finger and thumb of each hand After draining for a few seconds hold it over the glass plate, and allow a few drops of the solution to fall on the latter Then carefully lay the piece of tissue upon the plate downwards, and allow it to remain while another piece is immersed in the bath, and the air bubbles removed from it This done, the operator should return to the tissue on the glass plate, and, placing two fingers on one edge, pass the squeegee with moderate firmness slowly and evenly over the back of the tissue By this means it is made surface dry One application of the squeegee should be sufficient The piece of tissue is then raised slowly from the glass plate, and laid face uppermost on a sheet of blotting paper If it comes from the glass plate with difficulty it may be taken for granted that it has remained there too long The remedy is obvious

When the sensitised tissue has been laid on the blotting paper it is ready to be hung up to dry It may be either suspended by wood clips or hung over the cardboards mentioned as one of the necessary paraphernalia for the process These cards are recommended in the *Autotype Manual* to be prepared in the following manner "Tie a piece of fine twine, about 12in long, to the middle of one end of each piece of cardboard, at the other end cut a slit about ½in long exactly opposite, then make a knot in the twine, bend the card into the shape of a bow, slip the twine into the slit, the knot being on the outside, and you have an arch of cardboard to support the blotting paper on which the tissue is to be dried These cardboards can be suspended by passing a cord through them, or arranging splines to stick out from a wall or shelf"

The drying may be carried on in the sensitising room, provided that the latter is warm and dry Mr Sawyer declares that an ordinary fireplace gives the necessary minimum heat and maximum of ventilation, adding that the fulfilment of these conditions is the characteristic of ordinary English stoves If the sensitising is carried on in the evening, and there has been a fire in the room all day, the tissue ought to be dry the next morning It can then be taken down, cut up into the sizes required, and stored away in a tin box between boards, being kept flat by weights Another plan is to have "tin trays fitted with heavy lids just to drop inside them, the lids should be made of wood, with stout sheet lead of the same size as the wood screwed to the bottom By this means the tissue is kept flat in the most convenient form for the pressure frame, and the light and atmosphere perfectly excluded"

I think I cannot do better than incorporate in the present portion of this work the following quotation from Dr Liesegang, the well-known German authority on carbon printing It refers to the sensitising bath, and gives data only obtainable after long and intelligent research —

"After repeated use the bichromate becomes darker in colour, and is then useless For this reason the solution should not be used too sparingly, as soon as the bath loses its golden yellow it should be replaced by fresh solution The tissue will then keep longer, which is always an advantage A five-pint bichromate bath will sensitise one roll of carbon tissue in summer, two rolls in spring, and three rolls in winter

"In summer the bath should be kept as cold as possible, as in a warm bath, especially if it contains much bichromate of potassium, the gelatine will dissolve If necessary the vessel containing the bath should be placed in ice

"The stronger the bath is, the softer will the prints be, the weaker the bath the harder will be the prints Therefore, to print from a hard negative a stronger bath should be used, and to print from a very weak negative a very weak bath is necessary It must be remembered that tissue sensitised in a weak bath is less sensitive, and, therefore, requires longer exposure Too weak a bath yields no half tones, too strong a one produces reticulation (a net work structure) in the print"

It only remains to add that tissue can be obtained ready sensitised from the Autotype Company, at 8s 6d per band This is only 1s more than the band costs unsensitised Sensitised half bands may also be obtained The sensitised tissue keeps good about a fortnight or three weeks

Exposure of the Tissue —In exposing sensitive carbon tissue under a negative it is obvious that one very important deviation must be made from the course adopted in printing with paper sensitised with silver Silvered paper is white and the action of light upon it is clearly perceptible to the eye, but this is not the case with the black pigmented tissue For this reason it is necessary in carbon printing to have some additional guide to correct exposure, and it has been found that this desideratum is supplied by the ordinary silvered paper prepared as directed in the first part of the present work The silvered paper is exposed in a contrivance usually called an *actinometer*, or measurer of ray force, and, due consideration being had to the quality of the negative or negatives being printed from, and to the relative sensitiveness of silver paper and carbon tissue, it is found that the correct exposure can be judged with great accuracy There are various actinometers in vogue, but, for neatness and handiness, the one represented in the cut (Fig 7) is unsurpassed To quote the words of the inventor (written before it became an article of commerce), the Woodbury photometer is a cross

between Vogel's actinometer, where a series of layers of transparent paper forms a gentle gradation to opacity, and the instrument sold by the Autotype Company, in which, when the colour of the silvered paper arrives at one tint, the paper is again moved and another tint registered The first has the disadvantage of having to be opened to see to what stage the exposure has arrived, and the other that of requiring to be constantly watched for the moment when one tint is complete, so that a fresh piece of paper may take its place The Woodbury photometer remedies both these defects, and is, moreover, so handy and neatly arranged that to use it is almost a pleasure In shape it is a small disc like a watch, with brass back and glass front The latter protects the face, which is a paper disc, upon which are printed various depths of shade In the centre of the face is a small round orifice The "works" of the instrument consist of a tiny roll of sensitised paper, which passes under the orifice of the face and out through the side, as shown in the illustration The application of the photometer to carbon printing ought to be pretty obvious By preliminary test it is found what tint on the face registers the correct exposure of the tissue required by any particular negative, or, in other words, to what depth silver paper must be printed in order to show that the tissue has been fully exposed After very limited experience the preliminary test will be rendered almost if not quite unnecessary, a glance at the density of the negative to be printed from being quite sufficient It is obvious that if the negative is a particularly dense one the carbon print will not be finished until one of the deep tints has been reached by the sensitised paper, and *vice versâ* The necessary tint being settled upon, the frame containing the negative and the sensitive tissue is carried out into the light, the photometer being held in the hand When the tint has been reached by the silvered paper the printing frame is withdrawn, the print being, so far as exposure is concerned, an accomplished fact If there are other and denser negatives being printed from, the photometer remains untouched until the tints required by them are respectively reached The piece of sensitised paper, which has already done its work and hangs out at the side of the instru-

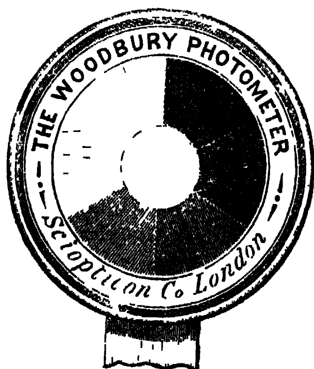


FIG 7 THE WOODBURY PHOTOMETER

ment, is given a pull, so that a fresh piece of paper may be released from the roller to pass under the orifice in the face It only remains, in connection with the Woodbury photometer, to add that it is obtainable of the Sciopticon Company, 157A and 157B, Great Portland-street, London, W It costs 5s, and is sent by post for 5s 3d The illustration, which represents the actual size of the instrument, does not show the discs of non-actinic gelatine, which are used in order to lessen the rapidity by which the light darkens the sensitised paper Without these the photometer may be used to ascertain the correct exposure for plates in the camera, provided that the films are not over sensitive

The remainder of the necessary appurtenances for exposing carbon tissue are not sufficiently distinctive to need separate mention They will obtain notice in the following brief account of the successive operations to be undergone in the actual course of printing

When the relation between the negative and the actinometer or photometer has been established, the fact should be duly entered either in a book or upon the negative itself This prevents any confusion or necessity for future preliminary tests The next operation is to provide the negative with what is technically known as a "safe edge" This is done either by pasting round the edge four strips of paper, or by running round a line of Bates's black varnish to the depth of about ⅛in The negative is now laid film side upwards in a printing frame, the back of which, by the way, need not be hinged as in silver printing, for the tissue will remain untouched until the printing is completed. A piece of tissue of suitable size is now selected and the surface gently rubbed down with fine muslin or wash-leather It is then laid on the negative and backed with dry bibulous paper and a piece of American cloth The frame is closed and carried out into the light, the exposure being judged by means of the actinometer or photometer, as explained above When the printing is concluded the frame is carried in, and the tissue removed for development The development should follow the printing as shortly as possible, for the curious reason that light has, upon carbon tissue, a continuating action, causing the image, as it were, to go on printing even in a dark room This extraordinary phenomenon was discovered by Captain Abney, and may sometimes be turned to good account. For instance, a picture which, through insufficiency of the light, has been only partially printed, can be completed by merely leaving it on a table in a dark room until the next day Of course this would involve certain calculations, but these need by no means be complicated, and, as Mr Sawyer says in the "Autotype Manual," it would be perfectly possible to organise a system having these data as a basis It has been found, moreover, that the knowledge of the continuating action has been proved of practical value in

preventing most successfully the washing-up of the half tones of the picture

Development by Single Transfer —The principal item in the requisites for the development of prints by single transfer is the single transfer paper, or support to which the image is transferred from the tissue This, to use the words of the "Autotype Manual," "is a fine paper prepared with a gelatinous or colloid substance, which, although insoluble in water, swells upon immersion, and acquires sufficient adhesive power to hold the picture both during development and finally" The Autotype Company send out the single transfer paper, in bands 12ft long and 30in wide, of either thick or thin texture For portraits a very fine paper in sheets is specially prepared, having a surface to imitate closely that of silver prints on albumenised paper The remaining necessary adjuncts for developing a carbon print by single transfer have been enumerated at the commencement of the present chapter

When the exposed pigmented tissue has been removed from the printing frame, it becomes necessary to cause it to adhere for some minutes to the transfer paper in order to effect the due transference of the latent image This is accomplished as follows We will suppose that, say, a dozen pieces of exposed tissue have just been removed from their respective frames, and that it is desired to proceed immediately with development To begin with, the operator must have at hand a corresponding number of pieces of single transfer paper cut to a size somewhat larger all round than the pieces of tissue A dish or pan of cold water, the squeegee, and some blotting paper will also come into requisition One of the pieces of exposed tissue is then immersed with one of the pieces of transfer paper in the cold water Directly the tissue becomes limp, its surface is brought into contact with that of the transfer paper, and the two, being brought out of the water, are laid upon a piece of zinc or any other level surface, the tissue being uppermost The squeegee is now passed over the back of the tissue two or three times, to squeeze out the water from between it and the transfer paper This done, the operation is repeated, the squeegee being used in the opposite direction, in order to expel the intervening air as well as the water The tissue and the transfer paper being now in contact, are laid between blotting paper, and the preceding operations are repeated with the remaining eleven pieces of exposed tissue This done, the first of the adherent pieces is ready for the next important operation, which consists in developing the latent image upon the transfer paper serving as a support For this will be required a tray filled with water in temperature from 90deg. to 110deg Fahr Almost immediately the coloured gelatine of the tissue will be seen oozing out from the edges The tissue is now

taken at one of the corners between the forefinger and the thumb, and drawn gently from the transfer paper The tissue, which is now useless, may be thrown on one side The transfer paper, which now supports the image, presents a slimy appearance, of the colour of the tissue to which it has been lately attached The development of the image is effected by simply splashing the warm water on to the surface of the transfer paper. This clears away by degrees the superfluous pigmented gelatine, leaving, after a minute or two of douching, a permanent picture, complete in detail and perfect in tone

It will be understood that the above results, attainable by so easy a method of working as that described, can hardly be expected except when the exposure of the tissue, in the first instance has been accurately timed For the benefit of my readers, I borrow from Mr Sawyer and the Autotype Company the following words, descriptive of the results of incorrect exposure and explanatory of the accommodating character of the process of which the authority quoted is the representative and referee —

"If the exposure has been too long, the gelatine compound will dissolve with some difficulty, and the resulting picture will be heavy in the shadows, and the lighter tones will be wanting in clearness If, on the other hand, the exposure has been insufficient, the compound will dissolve away quickly, leaving the developed picture bare and chalky in the high lights and lacking vigour in the shadows Of course, a proper exposure insures the most perfect result, but there is an advantage attending this process, that an under or an over exposed picture may be made fairly presentable by modifying the development—using hotter water than usual in the case of an over exposed print, and which may be further reduced by soaking for a time in water at a higher temperature, and, on the other hand, an under-exposed print may often be saved by removing it when partially developed from the warm water, and continuing the development in cooler water"

As the picture becomes a shade or two darker when dry, the operator need not be alarmed at finding it immediately after development a little too light

Directly after development the picture should be plunged into cold water to arrest any further action on the gelatine This done, it should be immersed in a solution of common alum (one part to thirty parts of water) until the yellow colour caused by the bichromate of potash has entirely disappeared Finally, the picture is freed from all trace of the alum by transference to a dish of clean cold water, rinsed, and hung up to dry

Pictures by single transfer, unless from reversed negatives, are

necessarily inverted This is of little account in the case of portraits, but renders reversed negatives absolutely necessary in the case of landscapes Methods of securing a reversed negative will be described hereafter

Double Transfer —There are three methods of double transfer applicable to the carbon process In the first, the temporary support (the meaning of which term will be more fully understood when I come to the actual description of the process) is afforded by indiarubber paper, in the second, the double transfer takes place from surfaces impermeable to air or fluid, of which collodionised glass is the usual representative, in the third, the indiarubber paper of the first process is supplanted by a "flexible support" The first process, namely, that of double transfer from indiarubber paper, is practically obsolete The second, particularly as represented by the use of collodionised glass, is greatly in vogue, especially for small work up to, say, 12in by 10in The flexible support is also in considerable use, but more for larger work, in which, from its simplicity and certainty, it is of unquestionable value

Before proceeding to details, there is an important point which I find it necessary to put plainly and simply before my readers This relates to the position of the public towards the Autotype Company, and *vice versâ*, in respect to patent rights Briefly, the matter stands thus On the 28th of February, 1878, expired the first of the series of patents acquired by the Autotype Company, and by its expiry the public were set free to practise (1) the preparation of coloured gelatinous tissues, (2) the production of photographs by what is known as the single transfer , (3) the production of photographs by the double transfer process, indiarubber paper being used as the temporary support

But besides this expired patent there are in the hands of the company five further patents, the earliest of which does not apparently expire until 1883 These are fully given in the Autotype Manual, and their application explained, but their recapitulation here would be unnecessary waste of space It will be better for us to explain the action of the Autotype Company with regard to these patents as affecting the public, amateur and professional In the first place, the right of employing these patents is granted through licences, which are of two kinds —chromotype and autotype The fee for the chromotype licence is £20 to professional photographers, but we believe a very great reduction indeed is made to amateurs A chromotype licensee may practise double transfer from collodionised glass, &c , and from the flexible support He is also free to adopt certain improvements in photographic printing frames, and in the production of enlargements, &c , introduced by M Lambert, a great authority on carbon work , finally, he is entitled (1) to the exclusive use

of three tissues approved by Lambert, as well as all the other tissues made by the Company, (2) to full instruction at the Autotype Works in chromotype printing and production of enlargements, (3) to the right to use the Company's registered trade mark, "Chromotype," (4) to a discount of 10 per cent from the market price of the Company's tissues The autotype licence, for which the fee is for professional photographers £5, and for amateurs only 5s, empowers the licensee to practise double transfer from surfaces impermeable to air or fluid (collodionised and plain glass, porcelain, opal, metal plates, &c), and from Sawyer's patented flexible support, which is described as a simple means of producing double transfer prints for transference to paper, ivory, opal, canvas, wood, &c

Now, all this about patent rights may seem very wearisome and unnecessary, but it is in reality important There is no end to the mistakes and complications which may arise out of ignorance, even though it be unstudied and genuine, of patent restrictions, and surely it is only fair and honourable towards legitimate commercial enterprise to respect the few barriers it temporarily erects for its own defence In the present instance, although the system of licences adopted by the Autotype Company be deprecated by some and chafed at by others, it is undoubtedly fair and above-board, while all accidental confusion and error with regard to them is rendered as far as possible remote by the elaborate explanation published by the Company itself with regard to its position

The exposure of the tissue in the double transfer processes is carried out in identically the same manner as that already described in connection with single transfer The process may thus be said to begin at the point when the exposed tissue is removed from the frames preparatory to development, which is carried out as follows —

Development, &c, by double transfer —The first requisite for development is a number of glass plates to serve as the temporary support Opal glass is decidedly preferable to ordinary glass, as the developed image is much more easily watched upon it Ordinary glass, however, will serve if held during development in front of a piece of white paper The plates, which should be a little larger all round than the pieces of exposed tissue, must now be waxed, which is accomplished with the aid of a compound made up by dissolving 100grs of pure beeswax in 20oz of pure benzole This is first rubbed into the plate with a pad of "papier Joseph," and then polished off lightly with a long clean pad of the same material. If the polishing is done too thoroughly the picture is liable to stick I believe that French chalk, used as in preparing plates for the reception of a coating of emulsion, may be employed with success instead of the wax solution

in benzole If waxed, the plates may be stored away for future use, all dust on their surfaces being removed with a camel's hair brush

The collodionising of the plates is the next step towards rendering them fit to serve as the temporary support during development This is done just as in the case of coating a plate with collodion for the negative processes The collodion should be plain and thin, the following formula will serve —

PLAIN COLLODION

Pyroxyline	12grs
Ether (methylated)	2oz
Alcohol (methylated)	2oz

When the collodion is well set, the plate is washed in clean cold water until the greasiness has disappeared Then take a piece of the exposed tissue, and placing it in a dish filled with clean cold water, allow it to remain there until it becomes limp In the meantime lay the rinsed collodionized plate in a position handy to the immersed tissue, allowing the surface to remain covered with water, so that the tissue may be subsequently adjusted before the squeegeing takes place Take the limp sheet from the water, and gently and gradually let it down middle first and ends successively upon the plate Superpose a piece of india-rubber cloth, and gently, but firmly, squeege out the intervening water The plate may then be laid down on a flat table, covered with blotting paper, and subjected to pressure for from five to fifteen minutes The easiest method of doing this is to cover the blotting paper with an ordinary glass plate, and lay a weight on the top The same process may be repeated with say a dozen plates, the weight being removed as each new plate, with its accompanying piece of tissue, requires to be subjected to pressure Vignettes or pictures with intended white margins should not remain under pressure for more than five minutes, for fear of injuring the purity of the whites

The plate, after pressure, is laid in warm water of a temperature not exceeding 100 deg, and (air bubbles being removed) is allowed to remain there until, as in the single transfer process, the pigment begins to exude at the edges of the tissue A corner of the latter is now raised and the whole skinned gently off The water is now dashed on to the plate, and the picture allowed gently and gradually to develop When the development is complete the plate is rinsed in cold water, flowed with an aqueous solution of alum—one part to twenty—rinsed again, and reared up to dry If no retouching be required the drying may be dispensed with, and the transfer paper applied while the plate is still wet from the last rinsing

The Autotype Company recommend for development a plan suggested many years ago by Mr. Johnson, which was "to have a vertical grooved

box in which the plates, after being skinned and the water well dashed over them, were placed to develope by themselves, the vertical position of the box giving, of course, every facility for the unfixed pigment to disengage itself, and leave the picture perfectly developed If the plan of the vertical box be adopted, one made to hold a dozen plates will be sufficient, and by the time the last one is put in the first will probably be completely developed, requiring, perhaps, only a little rinsing with warm water to make it complete"

In double transfer from collodionised glass any retouching or spotting must be done before the final transfer takes place, to prevent detriment to the brilliant gloss which is characteristic of these pictures We have seen no neater means of accomplishing this than the following method proposed by Canon Beechey and extracted from the Almanac for 1877 of the *British Journal of Photography* —"Your prints on the glass being quite dry, take them one by one to your retouching table, and examine them well If you find any transparent spots on them, or if in consequence of undue exposure the detail in the high lights has not come out, you can now remedy these defects in a very neat and simple manner Have by you a cup of hot water, and a very fine pointed camel's hair brush Take a slip of plain tissue, give it a soak in the hot water, lay it on your palette, and *use it for colour*, warm your plate, use hot water with your brush, and you will soon be able to touch-in the missing parts so that you will not be able to perceive that they were not printed By this means I have touched in many a distant mountain which had almost mingled with the sky, and deepened many details in the dark shadows, which have greatly strengthened the picture As the colour you use is exactly that of the print, and moreover it is gelatinous, you can work up the drawing with unfailing equality" It will be remembered that a similar method to the above was proposed by Mr Henry Cooper for spotting enamelled silver prints

The Final Transfer —It now remains to transfer the picture resting on the glass, which is its temporary support, to the paper destined to be its final one This latter is of a special character, and, to distinguish it from that used in the single transfer process, is called double transfer paper. The following particulars relative to it are furnished by the Autotype Company, who describe it as a paper coated with an enamel composition, insoluble in cold water, but becoming soft and slimy in water heated to a temperature of 120deg or 130deg. The enamel hides the fibres of the paper, and, containing opaque pigment, may be tinted or toned to any shade The paper itself is made in bands 12ft long by 30in wide, in either thick or thin substance, and in three shades of colour—viz , opal, azure, and rose The azure being a very delicate blue tint has the

peculiar advantage of enhancing the brilliancy of the high lights For portrait work the transfer paper is made in sheets very carefully by hand (also in the three tints named above), and coated with a dense pigment which entirely hides the fibre of the paper When required for use the transfer paper is cut up into sizes a little larger each way than the plates supporting the pictures, as many pieces as are wanted are then immersed in cold water for about half an hour until the gelatine is swelled Now take one of the glass plates supporting the pictures, rinse it under the tap and lay it down with the water still on the surface Pass a piece of the transfer paper through water, warm to about 110deg (a few seconds' immersion will produce the desired "sliminess"), and lay the gelatine surface down on the plate, *lightly* forcing out the intervening water with

If only unmounted pictures are desired, it merely remains to rear up the plates and the accompanying pieces of transfer paper to dry When perfectly dry apply a penknife to the edges, and the pictures will peel off, exhibiting a full and most brilliant gloss They should now be rolled collodion side outwards over something round of small diameter, to prevent their curling, as they will do unless this plan be resorted to If it be desired to obtain mounted pictures with full gloss, the directions given under the heading of mounting should be followed

Double Transfer from the Flexible Support —In this process a flexible support, invented and patented by Mr Sawyer, takes the place of the collodionised glass, the method of working with which is described in the preceding section In its use it is substantially the same as the collodionised glass, except in the case of the spotting or retouching, which cannot, as with collodionised glass, take place on the support itself, but must be reserved until the final transfer has been accomplished, when the pictures are spotted or retouched like ordinary silver prints Mr. Sawyer gives the following particulars of the Flexible Support, which should be noted by the operator In the first place, as to its composition, it is a paper made specially for the purpose, "coated by steam machinery very evenly with a solution of gelatine rendered insoluble by means of chrome alum When perfectly dry, this is again coated with a solution made by dissolving button lac or bleached lac in an aqueous solution of soda and borax, this is then dried and rolled with powerful pressure between polished plates Before using it must be treated in the following manner. Rub the glazed surface with a piece of soft flannel moistened with a little of a waxing compound composed as follows, yellow resin 6dr, pure bees' wax 2dr, turpentine 1 pint, having rubbed this well into the surface coating, polish it off with a second piece of flannel, let it

remain for a few minutes for the turpentine to evaporate, and it will be ready for use"

Recent improvements have been introduced which enable the Flexible Support to be used twenty times over, but it requires rewaxing each time before use

Mounting—All autotype prints may be mounted in exactly the same way as silver prints, by the same mounting media, and finished by the same subsequent burnishing, care being taken in the latter case that the print is quite dry before submitting it to the roller A preliminary warming is advisable

Autotype prints by double transfer from collodionised glass may be mounted with very thin starch and rolled, this gives the appearance of very brilliant albumenised paper If it be desired to imitate the surface of ordinary albumenised paper, the prints after stripping from the glass plates may be laid for an hour or so between sheets of damp blotting paper, and mounted while still damp

The Autotype Company give the following directions for the benefit of those who desire to mount double transfer prints from collodionised glass with full gloss "To accomplish mounting with full gloss some little practice and care is necessary Prepare some very thick dextrine paste by stirring dextrine into water, adding it little by little till a very thick mucilage is obtained It should be quite stiff, and have no lumps in it Place the cards upon which you propose to mount between damp blotting paper till they are quite limp and pliable, then, having the transfer paper on the pictures only surface dry, rub the thick dextrine well into the paper, and treat one side of the card in the same manner, lay the card down on the plate, and press every part into close contact, put the plates under pressure, with alternate sheets of damp blotting paper, for half an hour, then take them out, and put thin splines of wood round the edges, securing them with American clips, this will prevent their splitting off in the drying."

In mounting cartes, cabinets, &c, on the various cards designed peculiarly for these sizes, it will be necessary to mark on the transfer paper two corners (diagonals) of each picture as a guide where to lay the cards, This can be done by holding up the plate to the window, where the paper can be seen through and the position of the corners determined.

When thoroughly dry the cards may be easily stripped off the plate.

Carbon Prints on Opal—One of the most charming, if not the most charming, of all the many applications of carbon printing is the production by its means of pictures on opal glass Happily, moreover, this process is by no means a difficult one, in fact, anyone who can

print decently in carbon by either single or double transfer on paper ought to meet with similar success in working with opal Perhaps the only point where the beginner is liable to be led astray lies in the selection of the kind of glass to be used and the nature of its surface. There are two general classes of opal glass in the market, one of which, "pot metal," as it is called, is, if we may coin a word, opalined throughout, while the other, known as "flashed," has only a thin stratum of opal, the remainder of the glass being transparent Of these two the "pot metal" is distinctly to be preferred Again, as to the surface and "grain" of the glass The opal plate should be polished on one side and ground on the other The grain should not be produced either by fluoric acid or by what is known as the sand-blast process in which a blast of fine sand is directed against the glass, causing numerous little cavities which are the source of endless vexation of spirit to the carbon worker In a word, to quote the *Photographic News*, "The only proper kind of opal to use is hand smoothed opal, medium grain, neither too fine nor too coarse, the former not affording sufficient tooth to hold the picture safely, the latter giving a disagreeable coarse appearance to the finished work" It may be added that glass of this kind should be obtainable at the rate of a dozen whole plates for about 10s James Phillips and Co, 180, Bishopsgate street Without, London, E C, may be mentioned as a firm well known for the supply of photographic glass

As regards the colour suitable for the production of carbon pictures upon opal, the standard Portrait Brown tissue, as supplied by the Autotype Company, may be recommended for general purposes In particular cases, of course, other tints may be used with advantage, but the warm brown is a good all round colour, and may always be relied on Our readers may, perhaps, have seen Mr Faulkner's well-known portraits of children printed in a red tint, in these the Autotype Company's "red chalk" tissue has been used with extreme skilfulness and corresponding success

To turn to the actual operations of carbon printing on opal, it is first necessary to see if the negatives to be printed on are reversed or otherwise, as upon these conditions depends, to a great extent, the future manipulation If the negative be one taken in the ordinary way—that is, non-reversed—the double transfer process must be resorted to, if reversed, a single transfer will be sufficient.

To take the case of a reversed negative, first let us suppose that the tissue has been already printed to the requisite depth and removed from the frame. All that remains is to lay down the opal plate, which should have previously undergone a thorough cleaning, and, after plunging the

exposed tissue in water, to squeegee it on to the opal exactly as the exposed tissue is squeegeed on to the transfer paper in the single transfer process The development, washing, fixing in the alum solution, and final drying are substantially the same as in the single transfer process, the opal plate throughout representing the single transfer paper.

In working with a non-reversed or ordinary negative, the image on exposed tissue is transferred to the flexible support, and there developed and dried The next operation is to assimilate the surface of the opal to that of double transfer paper, which is accomplished in the following manner A solution of chrome alum, 12gr to the ounce of warm water, is rapidly stirred into a solution of Nelson's No 1 gelatine, 1oz to 9oz water, the solution being brought about by first swelling the gelatine in cold water and subsequently increasing heat until the gelatine is dissolved The opal plate is treated with as much of the above warm mixture as it will hold (either by the help of a tray or a levelling stand), and the flexible support, having been immersed in cold water, is squeegeed gently on to the opal When perfectly dry the support may be peeled off, the picture remaining on the surface of the opal

Pictures on opal may be easily worked up either in monochrome or colours, so as to present a very finished and artistic appearance

For further information on the subject of carbon pictures on opal, I have great pleasure in referring my readers to an exhaustive account of the process given by Mr T R Sawyer, under the heading of "Topics of the Day," in the *Photographic News* for 5th March, 1880

Miscellaneous Applications of Carbon Printing —Much as I should enjoy doing so, I fear I can hardly detail here all the various uses to which carbon printing may be most satisfactorily applied I will, however, give a bare mention of some of these, as even the mere knowledge of what a process *can* do is often instructive For all further details I must refer my readers to the *Autotype Manual* In the first place, carbon printing can be turned to account in providing a permanent basis for miniature painting on ivory For this the directions given under the head of carbon pictures on opal may be substantially followed, with the exception that, to avoid staining the ivory, the double transfer process should in all cases be resorted to

Carbon printing provides a basis for work in crayon, water-colour, &c, upon ordinary drawing paper, also for oil colour on canvas and panel Furthermore, it is used for reproducing drawings on wood, to serve as a guide for the engraver. Lastly, it is of peculiar utility for the production of transparencies of great excellence for decorative purposes, for lantern slides, and especially for enlargements. The use of carbon printing in the manufacture of transparencies will be illustrated in dealing

with that particular branch of photographic production, and also with the hardly less important subject of enlarging

Defects and Failures —As there is nothing perfect under the sun, so carbon printing, with all its beauties and its comparative facility of manipulation, has various little backslidings, which occasionally recur to plague its devotees and shake their faith It is only fair to state that these defects and failures—I hope my readers will understand the delicate distinction between the two words—are, considering the number and the nature of the operations involved in the process, remarkably few and far between Moreover, they may be said to be due, as I shall endeavour to point out, more to the operator than to any inherent shortcoming in the process It would be most satisfactory, indeed, if this chapter were consequently unnecessary, that is to say, if operators were so intelligent as to discover and rectify their errors without exterior assistance , but this, it is to be feared, is hardly the general rule Nevertheless, the operator may render the following list of defects and failures even more complete—in fact, exhaustive—by charitably bearing in mind the warning which needs such frequent repetition, to look to their own want of care and skill before blaming the tools and materials which wiser and more practised brains have placed at their disposal

Probably the most formidable and troublesome failure to be met with in carbon printing is one known as reticulation, or a network structure of fine lines covering the whole surface of the plate in the double transfer process with collodionised glass, to which process it is peculiar The origin of this is over-rapid drying after sensitising

Insolubility of the tissue, that is to say, when the tissue refuses to adhere to the transfer paper or the image refuses to develope, is due (1) to the presence of excessive free acid in the bichromate bath, (2) to exactly the reverse cause to which reticulation is due, namely, too protracted desiccation, (3) to the action of white light during drying or any period (except, of course, the exposure) of the operations, and (4) to the fact that the tissue has been kept too long after sensitising

The washing up of portions of the picture in single transfer, and in the first transfer of double transfer, is generally due to over long immersion of the exposed tissue before squeegeeing it on the temporary support Occasionally it occurs when there are deep shadows quite at the edges of a picture, these being liable to wash up from the margin of the negative having been masked This may be remedied by only partially masking the margin of the negative by using a thin margin of paper or paint, which allows a tint or two in advance of absolute whiteness to be printed.

The washing away of the half tones is usually due to the same cause

as that already assigned for reticulation, namely, undue haste in drying the tissue after sensitising

The washing up of the picture *bodily* in double transfer from collodionised glass is occasionally due to the fact that the collodion before immersion in water is not properly set Sometimes, moreover, when the surface of the collodion has been broken, water is imprisoned between it and transferred tissue, thus injuring the development

When the picture in the double transfer process refuses to leave the glass, the defect is owing to the plate not having been properly waxed This *contretemps* is usually met with in working with new glass plates, which must not be polished too closely after waxing

An unpleasant grain or texture in the picture after development may usually be attributed to a defective sample of transfer paper

Shining lines and specks occurring where deep shadows are in close proximity to high lights arise from the transfer paper not having been sufficiently soaked to render it pliable.

Besides the above defects and failures, there are bubbles and froth-like marking due to the intervention of air, the bubbles of which should always be most carefully excluded

Lastly, there are defects, principally represented by over-readiness of the picture to develope and consequent weakness in tone, arising from the bichromate bath not having been made of sufficient strength, or having lost its strength by use

General Hints —Keep the sensitising bath cool, if necessary, with the aid of ice

Practice squeegeeing carefully, as by a wrong method air-bubbles and water are not sufficiently expelled

Do not use the tissue for a day or two after sensitising

After skinning the tissue off the temporary support, do not be chary of the warm water, but dash it on vigorously

Double transfer paper hardens by long keeping When newly made, water of 80deg or 90deg will soften its surface, but after a time 120deg or 130deg will be necessary



CHAPTER III

THE PLATINOTYPE PROCESS

THE process we are about to describe is one introduced and patented by Mr W Willis, jun As its name suggests, it is a process for producing prints in platinum, and it is based upon the discovery that when a solution of ferrous oxalate in oxalate of potash is added to a salt of platinum—chloride, for instance—metallic platinum is immediately precipitated It is not necessary in the present case to go into the scientific details governing the preparation of sensitised paper for platinotype, as —if for no other reason—the sole right of preparation is in the hands of a company holding Mr Willis's patent, and acting as general agents for all articles connected with the process It will be enough to say that on exposing a piece of paper sensitised with salts of iron and platinum under a negative, a brown image of ferrous oxalate is produced, which, on being subjected to a "developer" of oxalate of potash, is reduced, and replaced by a black image of metallic platinum The chief merits of the process consist in permanency of results, great ease of manipulation, and high artistic value in point of colour

On the first introduction of the process there were various defects attached to it, which militated considerably against its popularity. By recent improvements these defects have been happily removed, and the process now stands forward as a candidate for popular favour, backed up by such strong recommendation that it has been determined to afford my readers every chance of at least giving a fair trial to the new power put into their hands.

Like the carbon process, platinotype is, as regards the supply of materials and the licence to work the process, in the hands of a company. Their address is the Platinotype Company, 2, St. Mildred's-terrace, Lee, London, S.E., and to them application for licences must be made. These last are granted for the whole term of the patent, and will be kept in force by an annual payment on the part of a professional photographer of £2 2s. To amateurs licences will be granted on payment of 2s. 6d.

for expenses. A trial, however, is allowed with a small quantity of materials procurable at the usual price, without a licence All licences will be subject to the condition that the sensitised paper and the chemicals used for developing be purchased from the company

And now let us turn to consider the apparatus and chemicals requisite for the practice of platinotype As regards the former, there is little enough to be said First will come what is called a "calcium tube," in which to keep the sensitised paper It is a *sine quâ non* in platinotype that the sensitised paper should be free from any suspicion of damp, and for this reason it is considered necessary to keep it in the continual presence—both before and after exposure—of calcium chloride, which has the well known property of absorbing the most imperceptible amount of moisture To facilitate the accomplishment of this object, tin tubes are constructed having a perforated receptacle to hold a sufficient quantity of calcium chloride, and called, therefore, calcium tubes A calcium tube 3in in diameter costs 3s , tubes of 4in and 6in in diameter may be had for 4s and 5s respectively The smallest of these sizes holds a quarter of a quire of sensitised paper comfortably When the calcium chloride in the perforated receptacle has become damp it should be removed, and not replaced until perfectly dry It may be dried over a fire on a shovel

For actual printing the ordinary frames are employed Great care should be taken to render both the frames and pads as free as possible from moisture The Platinotype Company, in their circular of instructions for working the process, recommend the employment of sheets of thin vulcanised indiarubber, which may with great advantage be placed between the sensitised paper and the back of the frame.

In development some sort of dish is required which will allow, as will be shown, the developing solution to be heated in it to about 180deg A porcelain tray *may* be used if care be taken to screen it from the direct action of the source of heat, but by far the best article for the purpose is a dish of enamelled iron These are purchasable from the Platinotype Company, one measuring about 10in by 7in (this is sufficiently large for whole-plate prints) costing but 1s 7d The heating agent for raising the temperature may be a Bunsen burner, with rose burner to spread the flame, or any other kindred contrivance We find an oil stove answers admirably Besides the iron dish used for developing, a tray or basin will be required for clearing. This may be of porcelain or glass.

The sensitised paper is sold in sheets, like albumenised paper, and of the same dimensions Before exposure to light it is of a lemon yellow colour. It is recommended for the beginner to purchase, say, a quarter

of a quire of this paper, which is sold at the rate of 22s per quire On receiving it from the company it should at once be transferred to the calcium tube, care, of course, being, moreover, taken that all actinic light be rigorously excluded when handling it during the process of printing

The developing agent, oxalate of potash, is obtainable from the Platinotype Company at the rate of 1s 6d per lb Sufficient to develope prints from a quire of paper costs 9d

The hydrochloric acid, used in very weak solution for clearing, is procurable of any chemist, photographic or otherwise, and ought not to cost more than 1s 6d per lb

Altogether, the photographer wishing to make a trial of the platinotype process may do so in a very thorough manner for the following amount Quarter of a quire of sensitised paper, 5s 2d , 3in calcium tube, 3s , enamelled iron dish, 1s 7d , oxalate of potash, say, 3d , hydrochloric acid, say, 1d , licence, 2s 6d , total, 13s 7d For this outlay about 200 carte de visite prints may be secured, while, of course, in the event of the trial being satisfactory, as it is sure to be, the cost of the tube, the iron tray, and the licence will not have to be repeated The price of a porcelain tray for clearing is not taken into account, as, although it is insignificant, the tray may be dispensed with, and a common hand-basin used instead

And now let us consider the actual *modus operandi* of the platinotype process Let us imagine that the sensitised paper has already been cut up into suitable sizes, and that a piece of it has been placed along with a negative in the printing frame There now remain three principal operations to be performed, namely, exposure, development, and clearing, which will now be detailed under their respective heads

Exposure —A significant fact in connection with platinotype is that, whether the exposure takes place in direct sunlight or in shade, the results are precisely the same This property is frequently of considerable value, as is also the uniformity of tone obtainable in platinotypes. As regards the length of the exposure, a very limited experience will enable the operator to decide when the paper has been sufficiently occupied. As already mentioned, the paper before exposure is of a lemon yellow colour, but, after being acted upon by the light, it becomes a pale greyish brown. If there be too much plain glass about a negative with strong contrasts, the deep shadows of a platinotype print from it assume a dingy orange tint, which is lighter than less heavy parts of the picture This means that complete deoxidation of the iron salt has taken place, and that the action of light will produce no further effect Solarisation is the name given the process by which this change is brought about. The inspection

of the print is managed in precisely the same manner as that adopted in silver printing, and the print, when the exposure is completed, if development does not follow immediately, should be protected from damp by being placed in a tin containing a little dry calcium chloride, or by being returned to the calcium tube

Development —As the sensitised paper is extremely durable, the development may or may not immediately follow the exposure, according to the convenience of the operator The following is the formula for the developer

DEVELOPER FOR PLATINOTYPES.

Oxalate of potash	130gr
Water	1oz

This, as it will keep indefinitely, may be made up in quantity To develope a print the developer is poured into the iron dish and heated to a temperature of about 170deg , if the print has been over-exposed, a lower temperature may save it, and, *vice versâ*, a higher temperature may improve an under-exposed one The print is now floated on the surface of the developer for a few seconds Almost instantaneously the yellow tint disappears, and the greyish-brown image gives way to one of a beautiful warm black, the high lights exhibiting extreme purity and the half-tones being rendered in exquisite delicacy and detail

Clearing —To clear the developed prints it is necessary to wash them in two baths of hydrochloric acid and water, one part of the former to eighty parts of the latter The prints should remain for eight or ten minutes face downwards in each of the two baths, the solution being agitated in order to give it free access to the surface of the print The second bath should be thrown away as soon as it becomes discoloured and a fresh one prepared in its stead To finish the prints they are rinsed and well washed for about half an hour, and dried preferably across glass rods or tubes

General Hints —Failures, which are singularly uncommon, are usually to be attributed to the sensitised paper having been affected by damp, causing it to print slowly, and producing weak, muddy tones Granularity is occasionally caused by the use of a developer at too low a temperature.

Great latitude is allowable in the temperature of the developer, from 100deg to 180deg not making any greatly appreciable difference At the same time, a standard temperature of 170deg or more is recommended, and exposures should be timed accordingly

When using the developer a second or subsequent time, the green crystals which may have formed should be left behind and thrown away,

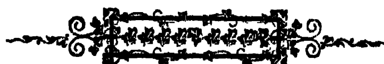
the solution being decanted from them and replenished from an unused solution of the same composition.

Prints of large size may be slowly pulled over a narrow trough containing the developer, it not being absolutely necessary to actually float them on the surface of the solution

Developed prints should never be transferred immediately to plain water before clearing

Such few residues as may be left over may be treated in the manner described in the circular sent out by the Platinotype Company

Concluding Remarks — Considering the comparative novelty of the platinotype process—at any rate, in its lately improved form—it will be well to give a few words to the claims it puts forward to popular adoption In the first place, it may be looked upon as permanent, owing to the undoubted stability of the metallic platinum forming the image The quality of permanence is, as we have already seen, shared by the carbon process, but then, again, platinotype is decidedly the superior of autotype in ease of manipulation Indeed, the facility, certainty, and rapidity of the process combine to render it an excellent means of securing proofs from a negative before sending it to be printed It is a curious fact that if you show anyone a really good platinotype, printed, say, with a mask, and abounding in delicate half-tones and brilliant lights, he or she will admire it immensely, and declare it to be better than any "photograph" But show the same person a silver print from the same negative, and judgment will at once be given in its favour. Why? Simply because there is a deep-rooted prejudice (for the most part utterly unreasonable) in favour of the tones and gloss of a silver print on albumenised paper No one will deny that the platinotype is far more artistic, and possibly some day the prejudice which does so much to render this most prominent merit invalid will disappear, at any rate, the day has come when platinotype can afford to stand on its own ground, since photographers of high standing have definitely acknowledged it by their own action to be the best of all means for printing landscape studies of any considerable dimensions.



CHAPTER IV

Photo-mechanical Processes—Introductory and Explanatory

Before going into the particulars connected with the various processes which this chapter is intended to elucidate, the attention of my readers must be drawn to what may be called the esoteric, or more than surface-deep, importance of the subject When an art or science has reached that point at which the necessity, or, at any rate, the desirability, of mechanical aid becomes apparent, it may be assumed that the art or science in question has made considerable progress since its earliest development But when the subsequent adaptation of machinery or mechanical appliances has been successfully accomplished, the fact becomes not only interesting, but noteworthy It is this stage which photography has reached, and it is in this aspect that it claims the close attention of those to whom its advancement is a matter of interest or concern For it is hardly too much to say that in the development of mechanical appliances the future of photography chiefly lies

Indeed, it may almost be said that the progress made by photography, as a science, will be insignificant compared to the strides it will make at no distant period towards becoming one of the most useful of the every-day arts by which our common comforts, as well as our æsthetic tastes, are studied In other words, to use an isolated illustration, the result of a year added to its history may find photography not only more popular, as being endued with greater facility and so forth of manipulation, but as being capable even of supplanting such time-honoured arts as engraving on copper, steel, and wood Indeed, the advances made in this direction are already considerable, as will presently be shown and proved. That these advances will ultimately lead to results which perhaps few of us can even imagine, must be left to time, and to the fair development of the exertions made, if silently, still surely, by the triple alliance of genius, experiment, and hard work

The majority of the photo-mechanical processes in vogue are based upon a principle identical with that underlying the carbon processes

already described, that is to say, the insolubility imparted to organic matter in combination with a bichromate, by exposure to actinic light An illustration of this will be found in[1] Chap I, where the production of a relief on a sheet of gelatine, sensitised in bichromate of potassium, exposed under a negative and then washed, is explained, as far as such results admit of general explanation The principles involved are applied in various ways to the production of reliefs on various surfaces, glass and stone being the most usual The subsequent inking in of the relief, or of a cast from the relief, and the "pulling" of proofs, will be explained under the headings of the different processes

Before going further, I may mention that the reader will profit greatly by reference on the subject of photo-mechanical processes to a most charming work, called "A History and Handbook of Photography," and written by M Gaston Tissandier This book has been translated from the French by Mr J Thomson, and for the sake of those who may not have seen it mentioned in other parts of this work, I may remark that it is published by Messrs Low and Marston, of 188, Fleet-street, E C In my opinion, the chapters on photo mechanical processes are the best in the whole book, not so much for details of practical working and so on, as for the most interesting and instructive sketch given of the various stages by which mechanism applied to photography has arrived at its present position Practical details will be found in the present chapter, but historical sketches are not comprised within the limits necessarily imposed upon a work like "Practical Photography" Nevertheless, I am pleased to be in a position to recommend to my readers a most reliable and attractive book, where all my unavoidable deficiencies on this score will be found amply supplied and made good I may add, that I think it more than probable that some of the bygone processes to which M. Tissandier as an historian gives a place, although years ago they may have proved comparatively unsuccessful, are in these days of increased knowledge susceptible of such improvement as may place them on a level with the best of existing methods

Photo-mechanical processes may be classed under two broad headings, namely, those which are instrumental in producing a relief, like that of a wood block, and those in which the print is obtained from a surface where the sunken portions represent shades, as in an engraved copper or steel plate. Technically speaking, they may be subdivided into "Photo-collotype," "Photo-engraving," "Photo-typography," "Photo-lithography," and "Woodburytype"

Photo-collotype is the reproduction of prints from a colloid surface, such as gelatine, the relief on which, caused by admixture of a bichromate and exposure to light, is inked in with a fatty ink, a piece

of paper is then superposed, the whole passed through the press, and the paper now impressed with the picture withdrawn The results of this process are in many cases extremely beautiful, possessing a dead black or other tone, and resembling prints produced by the process lately described under the heading of platinotype They do not require mounting, as with the aid of a mask they may be printed with clean margins, but they have the obvious disadvantage of not being able to be printed from along with ordinary type in a typographic press Like all other photo-mechanical prints, photo-collotypes are permanent

Photo-engraving may be briefly described as a means of producing, with the aid of photography, relief plates suitable for being printed from in a steel or copper-plate press

Photo-typography embraces all the processes by which a relief is obtained that can be printed from along with type It is in this direction that mechanical photography requires the greatest advancement, for the desirability of producing a photographic reproduction, which in a short space of time can be made to serve as a wood block, is one which few will care to repudiate

Photo-lithography is, as its name implies, merely a means of supplanting the image produced on stone in the ordinary method of lithography by one which owes its origin to photography It is used principally for the reproduction of maps, plans, MSS , &c

Woodburytype is a most extraordinary process, invented by the great photographic *savant*, Mr Walter Woodbury By its means prints are produced at remarkable speed, which are indistinguishable, except by a practised eye, from the most brilliant silver prints Woodburytypes have the one disadvantage of requiring to be mounted The method of producing them, in common with photo-collotypes, photo-typographs, and photo-lithographs will be described separately and practically

Photo-collotype —There are various collotype processes in vogue, all of which, while founded on identical principles and only differing in the details of their formulæ, doubtless possess distinctive merits The "Lichtdruck," or light printing, as practised in Germany, the collotype process, as introduced by Mr J R Sawyer, and extensively worked by the Autotype Company, the collographic process of Mr A Pumphrey, of Birmingham, and the photo-collotype process of Major Waterhouse, are all more or less the same, and all more or less connected with the original French processes practised by Tessié du Mothay, Marechal, and later by Geymet and others, and this fact materially increases the difficulty one experiences in choosing a process which shall be suited to the scope of articles like the present, and shall, moreover, possess the three necessary qualifications of thorough practicability, simplicity, and

power of yielding work of standard quality After careful consideration I have determined to place before my readers the outlines of the process already mentioned as due to Major Waterhouse, of the Bengal Staff Corps. It is more than possible that my readers will find that their own convenience will be studied by the acceptance of any modifications that may occur to them in choosing a press, in the adoption of any particular form of roller, in changing the nature of the supports, and other points upon which the following instructions need hardly be considered imperative

Major Waterhouse, who, as Assistant Surveyor-General of India, has had peculiar advantages for studying the applications of photo-collotype to the production, in particular, of maps and plans, describes his process in pp 30, 31, of the "Year Book of Photography" for 1877, to which we are indebted for the following extract —"It is the result of an attempt to find a simple method which should be comparatively independent of changes of weather and temperature It possesses the additional advantage that the sensitive surface may be easily prepared with a minimum of material, evenly and rapidly desiccated, whilst possessing great sensitiveness lasting for some days, good adhesion to the support, and finally sufficient strength to resist the wear and tear of printing"

As supports for the sensitive films, Major Waterhouse used flat sheets of copper, "grained" on one side as for engraving A glance at a card plate will illustrate what is meant by this These copper plates can be easily obtained through the nearest stationer, or, if economy be studied and large numbers be required, from any wholesale firm supplying such articles Such firms may be found enumerated in the *Stationers' Register* or other similar works of reference It is, by the way, in connection with these copper-plates that perhaps the only disadvantage of Major Waterhouse's process is to be found The plates are liable to lose their flatness, and, by consequence, it becomes difficult to insure their perfect contact with the negative under which, as will be shown, they are subsequently exposed. If the plates are thin, a strong pressure will overcome this difficulty, but, if otherwise, it is necessary to resort to other means, such as transferring the film of the negative to the sensitive surface in a bath of alcohol, or, to use a simpler method, by employing a negative transferred to or existing upon some flexible surface This point will be alluded to in discussing the various means for producing *reversed* negatives, which, it must be mentioned, are necessary in photo-collotype to produce a true reproduction of the original object.

These plates are washed with warm water, accurately levelled on the shelves of some sort of drying apparatus (that used in the preparation

of gelatine plates would answer), and coated with the following mixture, which is poured on like collodion, the excess being drained off so as to leave a thin even coating on the plates Major Waterhouse, by way of evidence and example, cites the fact that half an ounce of gelatine is more than sufficient to coat four hundred and fifty square inches of surface Here is the formula for the sensitive compound

Gelatine (Nelson's Opaque)	1½ parts
Water	100 „
Bichromate of Potash	4 „
Formic Acid	1 „

The gelatine is first dissolved in the water, the bichromate added, and, when dissolved, the formic acid

The plates whilst drying should be kept protected from dust It the coating has been well applied, and the plates are flat, the film should, in a temperature of, say, 120deg Fahrenheit, dry in the course of an hour or two with an even and glossy surface

Major Waterhouse recommends that the plates should not be used quite fresh, but allowed a day or two to harden He gives as a reason for this that, owing to the weak reducing action exerted by the formic acid upon the bichromate, the film would otherwise be tender and adhere to the paper during printing in the press

Exposure of the sensitive plate under the negative is accomplished in the ordinary way, an actinometer being conveniently used to determine with accuracy its duration The plates being, comparatively speaking, of great sensitiveness, from ten to twenty minutes in the shade is sufficient for negatives of ordinary density The exposed plates should be plunged into a trough of water for about five minutes, and will then be ready for the press

Major Waterhouse recommends the vertical pressure, similar to that obtained from the Albion printing press, as being less wearing to the surface and preserving the flatness of the copper plates Full and illustrated descriptions of several kinds of printing presses may be found by the reader in "Printing for Amateurs," published at *The Bazaar* office, price 1s

The ink may be that used in lithography, thinned down with a little olive oil The roller should be preferably of glue, although ordinary lithographic rollers, or those composed of catechu as sometimes employed in typographic printing, may be used with success

When the plate is taken from the washing water, the superfluous moisture is removed with a sponge, and the ink rolled in vigorously until all the details of the picture are distinct Owing to the slightness

of the relief this is an operation easily and readily performed. A piece of paper is adjusted on the surface of the relief, the tympan lowered, the pressure applied, and a proof "pulled" in the ordinary way. Damping and re-inking must intervene between each print.

The full operation of the process will be readily understood by anyone who has dabbled in either type printing or lithography, or, if this qualification is not forthcoming, by a short visit to the nearest printing office.

Another collotypic process is that practised by Mr. A. Pumphrey, of the Camp Hill Works, Emily-street, Birmingham, in the production of his so-called ink photographs. In this a mixture of

Gelatine	1½ parts by weight
Bichromate of Potash (pure)	¼ part ,,
Water	20 parts ,,

is spread upon a smooth surface such as glass or slate. The remainder of the operations are almost identical with those given above. Mr. Pumphrey uses a roller either of the lithographic pattern or composed of gelatine, with a mechanical admixture of some fibrous or inert body, which reduces the "lug" or "suck" necessary in typographic printing. All apparatus connected with his process may be procured from Mr. Pumphrey, it being identical with his well-known autographic process for the reproduction of plans and drawings after the manner of lithography. A paper free from glaze, and yet of close surface, serves as a fitting support for the picture; a medium cartridge is used, for instance, with success.

Concerning the heliotype process, which is patented and worked by Messrs. Edwards and Wright, of 61, Fleet-street, the collotype process of Mr. Sawyer, the process of Albert of Munich, and a host of others, plentiful information may be gained by reference to the almanacs of the *Photographic News* and the *British Journal of Photography*, and elsewhere. It is to be hoped, however, that the sketch given of Major Waterhouse's most excellent process will amply satisfy the requirements even of the most exacting or most backward of my readers.

Photo-Engraving.—I regret to say that the details which it will be in my power to give of photo-engraving will hardly bear comparison, as regards completeness, with those which I have happily been in a position to lay before my readers in reference to other branches of "mechanical" photography. The reason for this is that although photo-engraving, or the art of producing with the aid of photography plates similar to steel and copper plates, has attained a considerable degree of perfection, this is only met with at the cost of a great deal of labour and

skill, moreover, in those cases where photo-engraving has been most successful, the ways and means adopted have remained trade secrets In spite of these unfortunate facts, I will do my best to help my readers by giving them the outlines of the practical working of, at least, one process of photo-engraving, in the hope that should any one of them feel an inclination to adopt this most charming, though difficult, branch of the art, they will have something to begin upon by way of a foundation and encouragement for success

The process about to be described is due to one of the earliest pioneers of photography, the late Mr H Fox Talbot The inventor took out two patents for it, the first in 1852, the second in 1858 After his death an account of the process was contributed by his son, Mr C H Talbot, to the English edition of Tissandier's "History and Handbook of Photography," before referred to, to which we are indebted for the following details Those desirous of having ocular demonstration of the capabilities of the process will find two specimen plates in the translation of Tissandier's book, one illustrating the reproduction of an ordinary photograph possessing half tones, the other that of a subject only made up of lines—namely, a piece of the Ordnance Survey Map of Scotland It may be said that without doubt photo-engraving lends itself more readily to the reproduction of lines than to that of half tones, although considerable success has been attained in the latter direction

The plates used for the engraving may be either of copper or of steel. The former is the more easily worked, but the latter is more durable and allows a greater number of impressions to be pulled from its surface The method of using copper plates for the etching, and of subsequently coating the surface with steel, was ultimately adopted by Mr Fox Talbot

The photograph to be reproduced should be a positive, preferably a transparency on glass, but good results have been obtained from paper photographs rendered transparent by waxing

The copper or steel plate is first well cleaned and then treated with a mixed solution of gelatine and bichromate of potash prepared according to the following directions, as given in Mr Talbot's specification of his second patent About ¼oz of gelatine is dissolved in 8oz or 10oz of water by the aid of heat To this solution is added about 1oz by measure of a saturated solution of bichromate of potash in water, and the mixture strained through a linen cloth. The proportions are variable The mixture should be kept in a dark place, where it remains good for several months, requiring only to be warmed in cold weather, when the gelatine sets to a jelly

A little of the bichromated gelatine solution is now poured on the levelled copper or steel plate and allowed to dry, either spontaneously or

by the aid of heat, as in Major Waterhouse's collotype process The exposure is accomplished, as usual, by laying the photograph to be copied and the sensitised plate in an ordinary printing frame On exposure to light a negative image of a brown tint is produced

If the photograph to be copied be merely a line subject, the etching may now be proceeded with, but if it be necessary to reproduce half tones, the exigencies of practical working require a certain additional treatment of the broad shadows, which would otherwise print palely in the middle, owing to the fact that a considerable portion of the ink resting on them would be unavoidably cleaned off along with the superfluous ink which must be removed by the printer This defect is remedied by the provision of a number of minute nonprinting points (called by the inventor an "aquatint ground"), which is effected as follows A solution is made of common resin and chloroform in varying proportions A little of this is poured on the exposed plate, the result being that the solvent evaporates, and a thin film of resin and camphor forms on the gelatine surface Subsequent warming over a spirit lamp causes the camphor also to evaporate, leaving tiny particles of resin adhering to the surface of the film

The etching is accomplished as follows A saturated solution is made with the aid of heat, of peroxide of iron in muriatic or hydrochloric acid, which is strained and evaporated until considerably reduced in volume It is now stored away in conveniently sized bottles, where, as it cools, it solidifies into a brown semi-crystalline mass This preparation is called by Mr Talbot in his specification perchloride of iron When required for use three bottles are made up—No 1 of a saturated solution of this perchloride of iron in water, No 2 of a mixture of five or six parts of No 1 to one part of water, No 3 of equal parts of No 1 and water The etching is commenced by pouring a little of No 2 on the exposed plate and working the liquid over the surface with a camel's hair brush The etching should begin in about a minute, the parts etched turning dark brown or black The etching should not be allowed to proceed too rapidly, as the action requires some minutes' duration in order to give sufficient depth to the relief If the rapidity be too great, some of the No 1 saturated solution should be added, if not great enough, a little water to soften the gelatine When all the details are apparent, the operator having busily stirred the liquid the whole time with the camel's hair brush, it is wiped off with cotton, a stream of water directed on the plate, the latter wiped, and rubbed with soft whiting and water to remove the gelatine. The plate is now ready for the press

The above process of etching is modified by commencing with a small

quantity of No 1, which is poured on the plate and allowed to remain for one or two minutes It does not produce any apparent effect, but hardens the gelatine When poured off it is superseded by a small quantity of No 2, which effects the etching Local faintness is remedied by application of No 3 with a camel's hair brush without removing the No 2

The rest is merely a question of steel or copper-plate printing, about which I cannot enter in detail here There are many excellent works where the subject is fully treated, a useful, though brief account is to be found in a small pamphlet published by Mr D Berri, of Holborn, in connection with his People's Printing Presses

Besides the above, there are several most excellent photo engraving processes, the details of which are secret Amongst the best known are those of Messrs J Leitch and Co, Manning and Son, Dallas, Goupil and Co, and Herr Warnerke

Photo-Lithography —The process known and extensively practised under the name of photo-lithography comprises at least three distinct operations Of these the first, and, so far as photography is concerned, the most prominent one, is the preparation of a print in fatty ink which can be transferred to a lithographic stone This print is technically called a transfer Secondly comes the process of actually "laying down," as it is called, the transfer upon the stone, and, thirdly, that of producing the final prints with the aid of a press Before going further I should inform my readers that the above operations are also to be met with in the process known as photo-zincography, which, like photo-lithography, is used for the reproduction of maps, plans, and line drawings Indeed, the method of preparing the transfer is identically the same in both processes, so for the present it is hardly necessary to particularise them Points wherein the practice of photo-zincography differs from that of photo-lithography will be noted separately

There are various methods of preparing transfers, the best known of which is that termed the Southampton method, from the fact that it is extensively used by the Government at their establishment there, where the Ordnance Survey maps and other work of great importance are produced on a large scale

A point of primary importance in all the photo-lithographic methods of working is the negative To obtain anything like good results a means of intensification should be adopted which will give perfect transparency for the lines of the map, plan, or drawing to be reproduced, and perfect opacity to represent the whites of the paper The negative should be on glass having a very level surface, owing to the great pressure which it will have to undergo in the printing frame

The transfer paper is prepared as follows —A good sample of thin paper ("bank-post" is recommended) is selected and cut into pieces a little larger all round than the negative to be employed These are floated over a warm solution of Nelson's fine cut gelatine, one part to seventeen parts of water, for three minutes, after which they are hung up to dry away from all dust When dry, they are again floated over the warm solution and hung up by different corners than those by which they were first suspended When dry a second time they may be sensitised for one minute in a cold solution of bichromate of potash, one part to fifteen parts of water Finally, they are passed through a lithographic or copper-plate press to level their surfaces When sensitised the paper will keep a day in hot weather, a week in cold

Exposure is carried on until the picture appears as one made up of dark reddish brown lines on a yellow ground

The next step is to apply the necessary coating of fatty ink The following formula, as used at Southampton, is given by Captain Abney in his "Instruction in Photography"

Lithographic printing ink	8oz
Middle varnish	1oz
Burgundy pitch	3oz
Palm oil	½oz
Wax	½oz
Bitumen	1oz

The ink is first ground with the varnish on a stone slab The Burgundy pitch is melted over a clear fire to rid it of the water, the wax added in small pieces, and lastly the oil When properly melted these should ignite, the bitumen may now be added, and the whole ignited again The ink and varnish are now stirred in, the pot removed, and the contents, when cooled, poured into tins If the ink is too hard more palm oil should be added

To coat the exposed paper with this ink, a small quantity of the latter is worked into a very fine layer on a lithographic stone, sufficient turpentine being added to give it the consistency of honey A print is laid face downwards on the inked stone, and the whole passed once or twice through the press

The print being removed from the stone, and found to have been properly inked, is floated face upwards on water at about 90deg, until the lines are in distinct relief. It is next transferred to a glass plate, which must be placed in a sloping position to receive a gentle, but constant stream of water at about 150degs Whilst this stream is going on the soluble gelatine is tenderly removed with a very soft sponge. If it refuses to part it is recommended that the prints be soaked in warmer water for

about an hour and the sponge again applied When the sponging is complete the prints must be well washed in cold water and hung up to dry They should be preferably, but not necessarily, left a day before being actually transferred to zinc or stone

Besides the above there are two other methods of preparing transfers which deserve notice, and for particulars of which we can at least refer our readers to the best of all sources, namely, the inventors' own descriptions The first of these is one called papyrotype, and patented by Captain Abney, R E , who gives full working details in his "Instruction in Photography" Another method is advocated by Mr A Pumphrey, of Birmingham, already mentioned in connection with his collographic process, who contributed a paper on the subject to the *Photographic News Almanac* of 1879 Readers will also find a valuable paper on modern photo-lithography in the *Photographic News* for 12th March, 1880

The transfer having been satisfactorily prepared, it next remains to make ready the stone for its reception Doubtless most of my readers are familiar with the appearance of lithographic stones , it will be enough to mention that they are of a calcareous nature, very fine and compact, and that although they are to be found in various other parts of the world, the best qualities are imported from the quarries of Bavaria They may be easily obtained at low prices from any manufacturer of printing materials, as, for instance, Messrs Reed and Fox, of the Fann-street Foundry, Aldersgate-street, London, E C As imported, the stones have but a rough surface, which requires further grinding and polishing before use, and, in the case of small stones, such as those to which my readers will probably be limited, is effected by the simple plan of rubbing together by hand the faces of two stones, with silver sand and water between them The sand should be sifted and the water perfectly clean During the grinding the stones should be transposed, the top one taking the place of the lower, and grinding should be continued until the surface has been proved by a metal straight edge to be exactly level To *polish* the stone all grit is removed with a sponge, and the grain caused by the sand destroyed by passing over the surface a piece of soft pumice stone with plenty of water After a second washing a similar operation is gone through with water Ayr-stone (snake-stone), which is applied until great smoothness of surface is obtained. The whole operation of polishing will take half an hour or less For erasing an old subject the same system of grinding and polishing as described above may be adopted

Before proceeding to the actual transfer to the stone, it must be premised that the operator has possessed himself of a suitable press A new lithographic press, with side lever action, and a bed of 14in by 21in ,

costs at Reed and Fox's 11 guineas This price does not include tympan, leather, and boxwood scrapers, which involve a comparatively trifling extra expenditure It will be understood that this machine is one of first-class make, capable of producing any kind of work Cheaper presses can be procured, such as Waterlow's or Berri's People's Printing Press, the latter of which is particularly recommended to photo mechanical workers as being adapted to type, copper plate, and lithographic printing alike Mr D G Berri's press is made entirely of metal, and the pressure is obtained by means of a roller which can be altered to suit the impression The following are the first three sizes of the People's Printing Press, which with all materials can be obtained of the maker, 36, High Holborn No 1, prints a surface 4½in by 5in, £1 15s, No 2, prints 7in by 5½in, £2 18s, No. 3, prints 9¼in by 6¾in, £3 18s 6d

To effect the transfer, a well polished, dry stone is slightly warmed (either by holding it before the fire or by pouring boiling water over the surface and allowing the moisture to evaporate), dusted, and adjusted in the bed of the press A clean piece of paper is laid on the surface, the tympan lowered, and the whole passed under the press or roller to adjust the pressure, or, as it is technically called, the "pinch" This must be ascertained to be correct all over the stone, and, if necessary, rectified by inserting pieces of paper between it and the bed Now pass the stone two or three times through the press from end to end, so as to cause a still more perfect equalisation of pressure The transfer is now laid face downwards on a piece of blotting paper, and the back carefully damped with a moist sponge It is then taken up by two corners and laid on the stone, a sheet or two of clean paper superposed, the tympan gently lowered, and the whole passed through the press three or four times, the pressure being very slightly increased each time The tympan is now raised, and the condition of the transfer inspected If it adheres closely and evenly to the stone, it is again slightly damped on the back and passed through the press as before This done the tympan may be raised, and the transfer soaked to remove it from the stone The picture should now be found perfectly transferred in all its details When dry it should be gummed all over its surface with dilute gum arabic

At this point the functions of photography end, and what remains is simple lithography Concomitantly my detailed instructions must end, as this does not happen to be a manual of lithography. At the same time I think a slight *résumé* of the succeeding operations may lend completeness to the present sketch of photo-lithography, and cause it to be more intelligible to those who are not technically familiar with lithography pure and simple The following, then, is a skeleton sketch of what a lithographer would do with a stone to which, by the aid of

photography, a picture had been transferred as above described and explained To begin with, the gum is washed off the stone, and the picture a second time inked in with ordinary lithographic ink, just as it was before the transfer was effected This is done whilst the stone is still damp, as the action of lithography throughout depends on the repellence of water by the greasy ink, and, secondly, on the affinity of the greasy ink on the roller with that already on the picture To prevent the lines spreading the stone is now etched with very dilute nitric acid Damping and slight gumming again follow, then damping and inking An impression may now be pulled and the work proceeded with, damping and inking intervening between each impression

To those wishing to study the practice of lithography through the medium of a full and reliable manual, I may recommend "Instructions in the Art of Lithography," by C Straker, price 7s 6d (London Benjamin Winstone, 100, Shoe lane, E C), or D G Berri's "Book on the Art of Lithography," price 1s 6d

Photo-Zincography —Before receiving a transfer, a zinc plate, which can be obtained ready planished, should be grained by working brass founders' moulding sand (sifted) over the surface with a piece of zinc, the edges of which should be bent round a block or cork to prevent scratches The "mulling," as it is called, should be continued until the surface of the zinc plate is of a dull grey colour, and it should be performed immediately before the transfer is effected To accomplish this latter operation the zinc plate is screwed on to a planed block of wood to give it a height suitable for working in the press The transfer being effected, the zinc plate is well washed and fanned dry Captain Abney gives the following details for the succeeding operations A decoction of galls is made by soaking 1oz of bruised Aleppo galls in three quarts of cold water for twenty-four hours, the mixture is then boiled and strained A small quantity of phosphoric acid is also prepared by placing sticks of phosphorus in a bottle of water, the ends of the sticks being exposed to the air The following formula is then followed

ETCHING SOLUTION

Decoction of galls	1qt
Gum water	1qts
Phosphoric acid.	3oz

This is brushed over the plate with a broad brush and allowed to act for a few seconds, the plate is now wiped and again fanned dry Washing and inking follow as in photo-lithography.

Photo Typography —I have already remarked, in alluding to photo-typography, that in all probability such progress as yet remains in

store, at any rate for mechanical photography, will tend to the improvement of this most important and useful branch of the art Unfortunately, this theory implies, what is indisputably the fact, that photo-typography is at present in by no means a very advanced state Still, I venture to think I can see my way to furnishing my readers with particulars and hints which, at any rate, will be sufficiently practical to show what photo typography really is, and possibly to indicate the direction in which some advance on existing methods may be made by some intelligent reader with time, brains, and perseverance at his disposal

To begin with, let us consider the object of photo-typography and the appearance of a photo-typographic block Probably most of my readers are familiar with the appearance of the wood blocks ordinarily printed with letterpress They are doubtless aware that a woodcut is made up of lines of various thicknesses in relief, that by the action of the inking roller these lines in relief are inked in, and that a proof is obtained by superposing a piece of paper and passing it with the block through the press By this it will be understood that in relief blocks, such as those used in wood engraving and photo-typography, the reliefs represent the shades of the picture, the sunken portions the lights Hence the object of photo-typography is to provide a block in relief in exact reverse to photo engraving, where the sunken portions of the plate represent the pictorial lights

And this leads us to another and most prominent stage in our work This is the variety in the class of reproduction which photo-typography may be called upon to execute Broadly speaking, the variety consists of two kinds, namely, the reproduction of drawings in line, and the reproduction of nature in half tone Of these the first is in a comparatively advanced stage in spite of the difficulties attendant on its practice, but photo-typographic blocks of subjects in half tone are absolutely rarely met with in any degree of excellence, while such as have been produced are the result of operations which are trade secrets, and so more objects of admiration than of intelligent and practical interest The reason for this is the difficulty experienced in adapting the large expanses of comparatively unbroken relief which are met with in half tone blocks to the exigencies of letterpress printing, which requires something all over the block to hold the ink, as in an ordinary woodcut Before discussing the question of surmounting this difficulty it will be well to give some slight sketch of the reproduction of subjects in line by photo-typography, as, though this falls short of the other, it is still a step in the right direction, and may be looked on as a safe basis to begin upon

One plan of making relief blocks, which may be found mentioned in Captain Abney's "Treatise on Photography," is to coat a steel, copper, or zinc plate (preferably one of the two former) with a thin coating of asphaltum or bitumen of Judæa This is exposed under a negative, and the remaining soluble portions of the film removed by a solvent The relief is now produced by the action of a mordant The whole process is a difficult one, and the results often unsatisfactory, by reason of the fact that the help of the saw or graver has to be called in to make the plate workable

A simpler, and what seems to me a more practicable, method is the following, which was published two or three years back in an American journal, the *St Louis Practical Photographer* I give it as it was there given under the impression that it contains, at any rate, a correct principle, and one which is as simple as it is ingenious The process, which is called photo-stereotyping, is as follows A sheet of plate glass is coated with a solution made by dissolving 1oz of bichromate of potash in 15oz of water, warming gradually, then adding two ounces of fine gelatine, and filtering through linen at boiling heat The sensitised plate is exposed under a *positive* in diffused light for from ten to thirty minutes It is then taken into the dark room and washed with water for five or ten minutes, till the relief is wholly developed, after which it is dried with filtered paper and coated with glycerine by means of a camel's hair pencil, the excess of liquid being removed with filter paper From the relief plate thus prepared a cast is made in plaster of Paris of the thickness or consistency of oil, and from the plaster cast thus made a metal one may be taken in the same manner as that in common use among stereotypers of letterpress

I believe I am right in stating that at least one firm in London employs a process similar to the above, and obtains very good results, as may be seen in some illustrations which have appeared in *The Bazaar* and other serial publications and books

I am sorry not to be in a position to supplement the above details with any practical information concerning the production of half tone blocks, but I should like to record my conviction that the above process of photo-stereotyping seems to me to be more likely a step in the right direction than the more complicated method first alluded to What is wanted is to give a grain or some other means of holding the ink to the surface of the reliefs Possibly some modification of an idea utilised by Woodbury in kindred circumstances will be eventually found successful. This was to mix with the gelatine a fine powder, such as emery, which to some extent caught and held the ink as it was spread by the roller over the surface of the plate I am myself much interested in the solution of

the problem, and trust one day to be in a position to make public the result of experiments which theoretically, at any rate, are distinctly promising

Woodburytype —Of all photo-mechanical processes, perhaps Woodbury type may be looked on as the most remarkable, and, in some respects, the most successful Although the actual operation of printing is quite mechanical, and completely independent of such consideration as light and such supplementary aid as the toning bath, the results of the process are undistinguishable, except by an expert, from the best of silver prints In fact, in many cases a Woodburytype possesses a delicacy of detail unrivalled by the more unstable (for the Woodburytype is permanent) print in silver It may be mentioned that the process has been largely used for illustrating newspapers and books, indeed, a great number of the portraits sold in shops are produced by its aid

The working of the process has very recently undergone a distinct and important change Mr Woodbury's patent, which was, and is, worked by the Woodburytype Company under the able management of Mr Fry, has expired, and the process is now free to the public Again, important modifications have been introduced, enabling it to be practised conveniently by almost anyone, which was certainly not the case formerly. But the novelty of these modifications unfortunately precludes the possibility of giving such full and detailed instructions as might be desired The fact is that Mr Woodbury, to whom the first, if not the second, step in these modifications is due, went over to France, and there, we understand, entered into some arrangement not to give instructions in relief printing in this country However, the following ought to be sufficient for the intelligent photographer who has studied the preceding sections, while he will probably, at no distant period, have a complete manual of reference in "Woodburytype the Old and the New," a work which has been promised us by M Leon Vidal, the French photographer and correspondent of the *Photographic News*

To begin with, I must give a *résumé* of the process as it was worked until a few weeks ago The first stage was the preparation of a fairly substantial pellicle of gelatine very slightly tinted, but still transparent This was sensitised with bichromate of potash, exposed under a negative, and washed to remove the soluble gelatine, as in the collotype processes The result was, of course, an intaglio or image represented by hollows more or less deep This intaglio was now pressed into a sheet of lead by being laid on a perfectly flat and true steel tray, the walls of which were knife edges, superposed with the leaden sheet, and then subjected to the pressure of a hydraulic engine. The result of this pressure (which was truly enormous—something like a strain of 150 tons being required for a

carte de-visite picture) was the production of a mould in lead, the knife edges allowing the latter to fill up the tray precisely, and thus preventing injury to the gelatine mould, which could, strange to say, be used over and over again

This formed what may be termed the first portion of the process But the old order, which has yielded place to a new, had considerable draw-backs, centred around the use of the hydraulic press This was a formidable piece of machinery, particularly as regards the first cost, whilst the exigencies of pressure were so great that Woodburytypes of dimensions greater than 14in were seldom if ever produced But recent modifications have entirely done away with the necessity for this troublesome machinery All that is now required is a rolling press and a supply of tinfoil The intaglio is prepared as before, the composition of the pellicle being, I believe,

Nelson's Gelatine	200 parts
Water	100 "
Glycerine	20 "
White Sugar	30 "

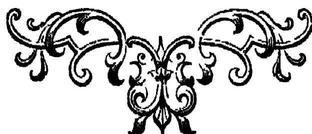
to which is added a little Indian ink to give it a tinge of colour This, being sensitised, is exposed not under a negative, but a positive It is attached to patent plate glass, and developed as before Now comes the real improvement, which consists simply in placing a sheet of tinfoil upon the gelatine mould, and passing both through a rolling press The result is that the tinfoil is forced into every hollow of the gelatine, thus, in fact, lining it with thin sheet lead, and rendering it equivalent to the leaden mould as produced with the expensive and troublesome aid of the hydraulic press

The remainder of the process is equally simple and ingenious The intaglio is slightly greased and placed in position on the bed of a press A pool of warm ink, formed by adding a fine pigment or permanent dye to a solution of gelatine in hot water, is poured on to the mould A piece of paper, strongly sized and of close even texture, is placed on the inked mould, and the top plate of the press, which is hinged, is brought down and secured by a catch The result of this is to squeeze out the superfluous gelatine, and when time has been given for the ink to set on the paper, which it does in gradations corresponding to that of the mould, the top plate is unlocked and raised, and the print removed Another pool of ink is poured on to the mould, and the operations repeated, each print being treated with a solution of alum to render the image insoluble

It is an important point that the top plate, which in the pattern press used for producing this class of work is of glass, should be perfectly level.

It may be easily understood that this press may be dispensed with by merely super-posing a thick piece of plate upon the back of the paper laid upon the inked mould, and by this means the ink would be properly squeezed out, supposing the picture to be of small dimensions It has been said that, in later modifications of the process, the mould has a level support in the shape of a glass plate to which the pellicle adheres, and which obviates the necessity for any bed for it to rest upon

Excepting that it is difficult to reproduce any large expanse of pure white, and that the prints require mounts and cannot be produced along with type in any ordinary typography, Woodburytype, particularly as regards excellence of results, may be looked upon as the most successful of existing photo mechanical processes



CHAPTER V.

REVERSED NEGATIVES

MORE than once, in connection with the single transfer carbon and the collotype process, for example, the necessity for a reversed negative has been alluded to As any interpolated account of the methods employed in securing reversed negatives would have injured the continuity of my descriptions of the processes named, I have preferred to postpone such account until I could give it a distinct chapter to itself With this apology, I will now proceed, first, to explain what a reversed negative really is, and, secondly, its mode of production To use a simple metaphor, a reversed negative is to an ordinary negative what the image of an object in a mirror is to the object itself It is a reversal of the composition of an ordinary negative, by which the left becomes the right, and so on

There are several ways of securing a reversed negative all more or less efficacious, but not equally convenient The oldest method is that of providing the negative (which should be unvarnished) with a layer of gelatine, collodion, or gutta percha, and then stripping the film bodily off the plate By printing from the side which formerly adhered to the plate, the results accruing from the use of a reversed negative are manifestly obtained The following *modus operandi* is said to be the best of those which are based upon the above principle The unvarnished negative is first coated with a solution of indiarubber in benzole, one to two grains to the ounce, which is allowed to dry It is then flowed with a transfer collodion, for which this formula is recommended

TRANSFER COLLODION

Ether	5oz
Alcohol 805	10oz.
Castor oil	¼oz
Pyroxyline	¼oz

This is allowed to dry The plate is then immersed in cold water, and if the film does not begin to appear loose in a few minutes an ounce of

sulphuric acid to a gallon of water should be added to hasten this result. Whilst still immersed, the edges of the film are run round with a penknife and the film itself gently detached from the glass The film may now be reversed, laid on a clean plate, and, on withdrawal from the water, gently squeezed on to it The above method, which is suitable for collodion negatives, has the disadvantage that the thin film is rather a tender object which, unless the manipulation is very delicate, stands a good chance of being rent in the operation of transfer

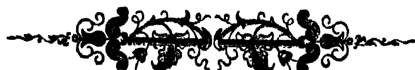
Another method consists in the employment of an instrument known as the reversing mirror An improved form of this is one manufactured by the Autotype Company, who use a surface of perfectly level plate glass, upon which has been deposited a coating of pure silver This is set at an angle of 45deg in a box fitting on to the front of the camera, the method of arrangement and fitting adopted by the Autotype Company being such that a mirror for any given size of lens may be adapted for use with any lenses of smaller calibre In taking views, portraits, &c the camera is turned sideways to the object, the resulting negative thus fulfilling, through the intermediate reflection of the sloped mirror, the necessary conditions of reversal The advantages claimed for the reversing mirror may be said to rest chiefly upon its employment for copying purposes, where the engraving, drawing, or other object to be copied may be simply laid on the floor instead of being necessarily placed in a vertical position Of course the mirror has in these cases to be placed so as to look down on the object A happy result of this is that the illumination being vertical there is a remarkable absence of texture or grain Again, great relief may be obtained with medallions or other objects requiring strong light and shade by covering over the top of the camera and using only a side light

A third plan, known as the "nitric acid process," is a very neat and, if properly carried out, a successful one Under any negative of which it is desired to have a reversed representative is exposed a plate containing preferably only silver bromide (chloride being admissable, but not iodide), as, for instance, a collodio-bromide dry plate This is developed with alkaline pyro or ferrous oxalate, and well washed The plate is now fastened on to a pneumatic holder, and a little of the best and purest nitric acid flowed over it The result is a picture in which clear glass represents the deepest shadows, and so on This is now exposed for a second or two to daylight, or for a longer period to the light of a lamp, and on returning to the dark room is again treated with the developer, alkaline pyro, or ferrous oxalate, as the case may be. This causes the image to darken until a negative (reversed) of the ordinary description is obtained. The disadvantage of the above method

consists in the difficulty experienced in keeping the film on the plate after the application of the nitric acid. A simple cure has been suggested by Mr. Edward Viles, whose article on the subject of making transparencies by this process is well worth reading. That gentleman simply draws a tallow candle all round the edges of the dry plate before it has been wetted in any way, so as to leave a greasy margin of about ¼ in. This water-repelling edge is recommended to all who are troubled with slipping films.

For an account of two processes of more recent introduction than those already enumerated, I am indebted to the *British Journal of Photography*. The first of these is due to Mr. Thomas Bolas, F.C.S., whose Cantor lecture on photo-mechanical processes, published in the *British Journal*, is entitled to all possible respect. His method consists in treating an ordinary gelatino-bromide dry plate with a solution of bichromate of potash, and exposing it under a negative for the same period as that required for a carbon print. On developement by alkaline pyro or ferrous oxalate, a reverse negative results. An advantage of this method is that dry plates which have been accidentally exposed to the light may be used; even those which have been developed need not be discarded, the image being removed by means of a solution of bromine in water and the plate washed before the application of the bichromate of potash.

The last method I shall mention is one introduced by Mr. W. Brooks, of which a favourable opinion has been recorded. In operation it resembles the nitric acid process, a film containing only bromide of silver (collodion by preference, although gelatine may be used with careful treatment) is exposed under a negative and developed. The image is now treated with a solution of iodine in alcohol (the ordinary tincture of iodine of the Pharmacopœia diluted with half its bulk of water may be used) until, so far as reflected light is concerned, the image quite disappears. An exposure of a second or two to the light now follows, then a second application of the developer, which produces the desired result of a reversed image of standard quality.



CHAPTER VI

TRANSPARENCIES.

THE ability to produce at will a good transparency is of no small importance to the photographer. In the first place transparencies are of great practical utility, of which the multiplication of negatives, and, above all, the production of enlargements, are prominent instances Again, they may be looked on as important additions to what may be termed the ornamental side of photography There are a thousand and one pretty uses to which they can be applied To begin with, a simple transparency, backed with some translucent substance, such as ground glass, or coated on its silver side with a saturated solution of white wax in ether, to each ounce of which after filtration another ounce of ether has been added, forms in itself no unattractive ornament But a very limited ingenuity will rapidly enlarge upon this, and "storied windows richly dight," not to mention lamp shades, and screens of many descriptions may easily become accomplished facts in the house of the tasteful photographer. Lastly, there is a use for transparencies which is both of a practical nature and furnishes considerable amusement at no great expense of trouble, money, or time I am alluding to the production of photographic slides for what has been for many years known by the unfortunate name of the magic lantern

Amongst the various methods of making transparencies, perhaps the first to be mentioned is that in which a special copying camera or some kindred contrivance is required Into this I shall not go in detail, as, in my opinion, the method is quite superseded by others more new, which are less complicated and quite as efficient. The processes which I shall describe are so simple that they may be practised by anyone; moreover, they require little, if any, special apparatus, while giving the best possible results.

To begin with, I will again revert to the nitric acid method, which I alluded to in the preceding chapter on Reversed Negatives. In the case of transparencies, the mode of procedure is naturally different.

Instead of recourse being had to a negative, the transparency is a direct one, that is to say, taken from the object at one operation A collodio-bromide plate is used, and exposed about one third longer than would be necessary for a good negative Developement (which must be pushed much further than in the case of an ordinary negative) follows, then the washing, the application of the nitric acid, and the other operations as previously detailed The most important point is, perhaps, the correctness of the exposure, which, while full, should not be overdone In the second application of the developer, the latter can be weakened and rendered more under control, if desired, by the addition of a little water If, after all, density is wanting, the plate may be floated with a saturated solution of copper chloride, to which an equal bulk of water has been added This causes the transparency first to assume a brown tone (which may be preserved, if the picture is already dense enough, by simply washing off the solution), next to whiten until the image almost dis appears, when the alkaline developer may again be applied to bring out the picture The advantages of the nitric acid method are that the operation is direct, and that, partly from this reason, partly from the merits of the process, the pictures possess extreme delicacy, rendering them of peculiar utility for the production of enlargements and for employment as slides in the optical lantern Perhaps the only apparent disadvantage is but an advantage looked at from a different point of view The process being a direct one, it is not possible to utilise old negatives Again, in cases of transparencies of large dimensions, the manipulation would become difficult to a prohibitory extent

The next means of making transparencies is a very simple one, and will especially commend itself to dry plate workers, both in collodion and gelatine A dry plate is placed under an ordinary negative in a common printing frame The exposure to daylight in the case of a moderately sensitive plate should hardly exceed a second, but it is preferable to expose it for a proportionately longer period to the light of a lamp constructed on any of the better known principles. After a few trials the exposure may be ascertained with extreme accuracy, and a great number of transparencies obtained in the course of a single evening Developement naturally follows, and if ferrous oxalate be used, no toning will be necessary, otherwise, the picture may be toned by immersion in the following

TONING SOLUTION

Chloride of gold	1gr
Hydrochloric acid	6 drops
Water	10oz.

A third transparency process is taken from carbon printing, and is, perhaps, the simplest and most likely to be adopted of all A glance at

that portion of the chapter on carbon printing where double transfer comes under notice, will explain the method fully and perfectly A piece of sensitive tissue is exposed under a negative, and transferred to a waxed or chalked glass plate Developement in hot water follows, the tissue being stripped off, and the transparency all ready toned remaining The fixation in alum may be carried out as a precaution

Lastly, most exquisite transparencies may be secured by Woodbury-type, glass being used instead of paper as the final support Amateurs may, perhaps, not incline to this method, but a glance at the magnificent series of slides produced by it, and published by the Sciopticon Company, of 157B, Great Portland-street, W, will convince them of the capabilities of the process for this branch of work

The consideration of transparencies leads to the very simple means by which a negative may be reproduced almost to infinity The method should be obvious from the original negative is taken a transparency The exposure of a dry plate under this of course results in a negative



CHAPTER VII.

Photography by Artificial Light.

Few will deny that a peculiar interest is attached to the question of photography by artificial light. Be it midday or midnight, a portrait can always be taken by its aid, provided the appliances are correctly adjusted and administered, and what is even more important, the exposure is small beside the exposures often rendered necessary by the use of the wet collodion under ordinary circumstances, while the results are all that can be desired. Witness the pictures turned out with the aid of the electric light by Van der Weyde and the Stereoscopic Company, both of Regent-street. Moreover, the quality of light being uniform, it needs but a few experimental trials to arrive at uniform correctness of exposure, one of the secrets of success in portraiture as in every other branch of photography.

The Electric Light.—Amongst the various kinds of artificial light that may be used in connection with photography, the most prominent is that obtained by means of electricity, which will, perhaps, be best understood by an inspection of some such pattern establishments as the two before referred to, where the electric light lends its aid to the production of portraits rivalling the best work done in ordinary daylight. In one of these the light is produced by two of Siemens' dynamo-electric machines, one capable of producing a light equal to 6000 candles, the other a light equal to 2000 candles. These are worked by an eight horse power silent gas engine, costing about £250. The dynamo-electric machines may be put down at about £200. The above are in the cellar, while connected with them, by large conducting wires of copper, is an electric lamp with the usual carbon pencils, which stands in the studio upstairs, and the light from which is reflected on to the sitter by a large concave reflector lined with enamelled paper. The total cost of the whole apparatus may be put down at about £700. Of course such a price as this is, except in rare cases, prohibitory, but the above details are quoted to give a general idea of arrangements which, perhaps, as nearly approximate to perfection

in this particular branch as any in existence It must be understood that by far the best, if by far the most expensive, method of producing the electric light is that in which, as in the studios cited, the dynamo-electric machine is brought into use, and when the quality of the light, and the ease with which the whole apparatus can be started at a moment's notice, are brought into consideration, cases will be readily imagined when a price quite prohibitory to the ordinary amateur might be profitably approached by the enterprising professional

But, as every reader to whom electricity has been ever so limited a study should know, there is another, and, so far as expense is concerned, a vastly less formidable means of producing the electric light besides that of which an outline has been given This is the voltaic battery, familiar to many through the toy electric lamps sold for a shilling or two, in which a light is obtained with a tiny battery contained in a jampot or other kindred contrivance I will assume it to be a well-known fact that the light may be increased in power by multiplying the elements of a battery, that is to say, by using forty or fifty "Bunsen's" or "Grove's" cells instead of one I do not think, moreover, that I need enter into the detailed construction of the separate elements of a battery, as that is a point which belongs to the department of electricity, and does not lie within the scope of the present work But I should like to recommend my readers to a quarter in which, perhaps, more reliable and practical information can be obtained concerning the application of electric light to the specific purposes of photography than can be found in any existing manual I speak of a series of articles contributed during January, February, and March, 1879, by Mr G F Williams, a practical electrician of many years' standing, to the *British Journal of Photography* Again, I think that, perhaps, even to readers who are acquainted with the subject, a few words "by the way" may not be unacceptable Firstly, I cannot do better than illustrate the principles involved in voltaic electricity by the following simple explanation given by the writer mentioned above In a battery jar (for which one of the jars used for table salt may well be employed) is placed a plate of amalgamated zinc in diluted sulphuric acid, little or no action is visible In the same jar is placed a "porous cell," containing either a piece of platinum foil or a plate of gas carbon, and nearly filled with the strongest nitric acid If the platinum foil be used, we have Grove's battery, if carbon, Bunsen's modification of it Now connect the zinc with the carbon or platinum by a wire, and a brisk chemical action ensues If a short wire be attached to the zinc and another to the carbon, and their ends rubbed together, a spark will be seen every time the contact is made or broken. This is *current* electricity.

To pass on to the actual provision of a battery capable of producing sufficient light for purposes of portraiture, I am indebted again to Mr Williams for the following very practical information relative to the materials necessary for the construction of a battery, and their cost In his series Mr Williams describes six types of battery which should be suitable to the requirements of every photographer Of these the most expensive is one consisting of fifty cells, square form, Grove's, 7¼in by 4¾in by 2¼in inside, platinum being used instead of carbon This costs about £20, while to charge it costs 12s The cheapest on the other hand is one consisting of fifty cells, square form, Bunsen's, 5⅜in by 3⅜in by 2in inside, costing but little over £6, the charge coming to 6s 3d extra It may also be useful for the inexperienced to know that battery jars and porous cells can be obtained advantageously from Messrs Stiff, Lambeth, S E , zinc from Braby and Co , or Treggon and Co , London , carbon blocks and plates from Thorpe and Hancock, Howard-street, Wandsworth road, S W (wholesale) , brass clamps, from Davis and Timmons, Bowling Green-lane, Farringdon road, E C (wholesale) , platinum, from Johnson, Matthey, and Co , Hatton garden, E C , acids, from Pass and Boome, Weston-street, Bow Common, E

As regards the lamp, the photographer must be left to his own discretion It may be mentioned that Siemens' automatic lamp costs £15, Serrin's, £14 but these are very perfect instruments indeed Strictly speaking, the photographer does not absolutely need a lamp, as the light only being required for a few seconds, any simple contrivance for holding the carbon pencils will be sufficient

It is recommended that, if possible, the battery should be kept in an out-house by itself, to facilitate the renewal of its charge, and to lesson the annoyance of the fumes arising from the acid Connection may be made between the cells and the lamp by strong gutta percha-covered copper wire

As regards the lighting of the object, good results have been obtained by placing the lamp about 5ft from the floor and somewhat in advance of the sitter A screen of *papier mineral* is interposed, and a reflector used on the shaded side

In conclusion it should be remarked that to avoid the unpleasantness of the nitric acid fumes it has been suggested by Mr J W Swan to employ an acidified bichromate of potash solution instead of the zinc and carbon combination This, with various arrangements calculated to lessen the trouble of constantly attending to the battery, will be found entered into at length by Mr Swan in pp 129—132 of the "Year Book Photography" for 1879.

Pyrotechnic Lights—It has long been a well-known fact that consider-

able actinic properties may be found to exist in the light obtained by igniting compounds similar to those commonly used in the manufacture of fireworks But the employment of these pyrotechnic compounds is attended with much inconvenience by reason of the fumes arising on their ignition Again, it would hardly be possible to secure a satisfactory portrait by merely lighting a certain quantity of an actinic fire in the neighbourhood of the sitter Some system of reflection must be used to concentrate the rays, and so to harmonise the lighting Hence it becomes necessary in working with a pyrotechnic compound to do so in connection with some sort of special apparatus calculated to show the light off to its greatest possible advantage, and furthermore to carry away the obnoxious fumes Various patterns of apparatus have been devised with these ends in view, all more or less successful The earliest of these was the Photogen of Mr John Moule, which we believe can still be obtained from Solomon, of 22, Red Lion-square, for £5 10s The Photogen consists simply of a huge white-lined reflector, in the centre of which is an arrangement for supporting the compound, which is fired by hand, the smoke being carried away by a chimney A more pretentious instrument, constructed on a not very different principle, is the modern Luxograph In this the light is softened by being transmitted through some such medium as tissue paper The Luxograph has been patented by Messrs Alder and Clarke, from whom all particulars can be obtained, at 9, West Strand, S W The total cost of the apparatus complete, with every fitting needful to take any sized portrait from carte de visite up to 24in. by 18in , either bust, head, or half length, is £35. If it be required to take full length or three-quarter figures, a larger apparatus, costing £50, is recommended With these sums is included the licence to work under the patent The cost for exposure, with a rapid gelatine plate, is under a penny The instrument can be viewed at the studio, 9, West Strand, and special demonstrations are occasionally given for the benefit of photographers generally

An apparatus which, I think, is destined to enjoy far greater popularity than the foregoing, while hardly, if at all, inferior to them in the character of its results, is one the introduction of which is due to Mr. R V Harman, of Bromley, Kent From the following simple description any person of average intelligence should be able to construct one for himself, which will suit every purpose of ordinary portraiture, but it should be mentioned that a well-made instrument of metal, complete with trivet and saucer, may be obtained from Mr Harman himself at the extremely moderate cost of 25s The construction of the apparatus is essentially as follows Imagine an ordinary deal case of cubical form, measuring about 2ft. 6in every way Now, suppose this cut in halves,

diagonally Take one half and rear it up on end, cutting a hole in the top for the chimney, and covering over the open front with tissue paper, excepting a space of about six inches from the bottom, which serves the double purpose of allowing the composition to be easily fired, and of creating the necessary draught The piping for the chimney may be made of cardboard bent round, and pasted paper, and may be let out into the open air through a window, roof, or chimney breast The instrument itself may be placed about three feet from the floor, and a little in advance of the sitter, a screen covered with white paper serving as a reflector on the shaded side A trivet stands on the floor of the instrument, and supports a saucer filled with dry sand A sufficient quantity of the compound (which will necessarily depend on the rapidity of the plates used) is taken in a wineglass and emptied in a pyramidal heap on the sand When ready to expose, a vesuvian or pipe-light is dropped into the centre of the mixture

The following is the formula for a pyrotechnic compound, given me by Mr Harman, with directions for its preparation

PYROTECHNIC COMPOUND

Nitrate of Potass	1¼ lb
Flour Sulphur	¼lb
Sulphide of Antimony (black)	1oz
Ground Charcoal	½oz
Camphor	1oz

Break the camphor up small and dissolve it in about 3oz or 4oz. of methylated spirit in a basin When dissolved, stir into it some of the powder, a small quantity at a time, until it becomes stiff, and then thoroughly mix the whole together

Keep the above, when not in use, in a tin or box in a dry place, as damp will considerably affect it

I give a second formula, proposed by Mr J Barker, in the "Year Book of Photography" for 1880

Nitrate of Potass	20 parts
Sulphur ..	8 ,,
Sulphide of Antimony	4 ,,
Loaf sugar	4 ,,

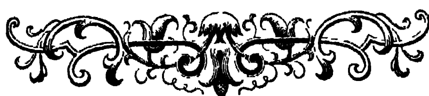
If extra rapidity of exposure be desired, add about half a part of magnesium. The ingredients should all be powdered separately, then mixed and strained through a hair sieve, as care is necessary when mixing sulphur with potass

Magnesium Ribbon — At first sight the employment of magnesium ribbon in portraiture by artificial light seems to offer no practical obstacle whatever. The light itself obtained from this source, as everyone knows,

is of surpassing brilliancy and whiteness, while the ribbon seems so cleanly and so handy that by its side the electric light with its troublesome paraphernalia and pyrotechnic compounds, with all the nuisances attendant on their preparation and combustion, seems to have no chance Moreover, the ribbon can hardly be said to be expensive when we consider that its present price is about 12s the ounce, and looking at the number of yards contained in that quantity, a number which must be seen to be believed But magnesium ribbon has the drawback of being not quite so easily combusted as some would imagine It is all very well to break off an inch and deliberately expose it to the action of flame until it fires, but it is quite another thing to manipulate it in such a way as to render it efficacious in portraiture To begin with, one single strand of ribbon hardly gives sufficient light except with a prolonged exposure, and to keep a single strand equally alight for even a few seconds, the necessary reflector being taken into consideration, requires, if not an assistant, at least much dexterity and care Several contrivances have been suggested, whereby as many as twenty strands of magnesium ribbon could be ignited at once, but they are hardly so simple and practicable as might be wished Perhaps the only way of working the ribbon with any success, combined with comfort, is to employ one, or, better, two of the well-known magnesium lamps These have in their interior a roll of the ribbon which is paid out by a neat clock-work arrangement, as it is gradually combusted The speed is regulated by two small fans enclosed in a cap at the top of the clock-work, the general rate of burning being about one foot per minute Magnesium lamps can be obtained from the patentee, Mr J Solomon, of 22, Red Lion-square A No 1 lamp, with silver reflector, costs £2, the rollers, with adjustment, 10s

Gas Light —That ordinary gaslight may be successfully adapted to purposes of portraiture has been proved by Mr P E Laws, of Newcastle-on-Tyne Much credit is due to this gentleman, not only for the originality of his idea and the painstaking thoroughness with which he has worked it out, but particularly for the liberality with which he has placed the result of his experiences at the disposal of photographers generally through the medium of the *Photographic News* Like most happy ideas, that of taking portraits by gaslight is strangely simple. The key to it lies in the employment of a burner of extraordinary capacity Mr Laws uses one of Wigham's, consisting of sixty-eight jets, capable of yielding an illuminating power of 1250 standard candles, and costing £5 The large flame produced by this is backed by a reflector, lined throughout with strips of silvered glass, a shape akin to that of a Dutch oven, only domed instead of being angular, is employed by Mr Laws, who also places a screen of violet glass between the flame and the sitter With

extra sensitive gelatine plates, such as those prepared by Messrs Mawson and Swan, of Newcastle-on-Tyne, the exposure has been reduced to as low as eight seconds for cartes-de-visite It may be added that Messrs Mawson and Swan have undertaken the agency for the supply of apparatus similar to that employed by Mr Laws, and that from the latter gentleman specimen photographs can be obtained at a low cost, proving that the practical results of his process, as well as its theoretical advantages, are all that can be desired



CHAPTER VIII

Enlarging Processes.

Before detailing the various existing processes of enlargement, there is one little technical expression connected with this branch of photography which deserves explanation This is the expression "diameters," which is generally used to convey the degree of an enlargement with reference to the size of the original negative or print from which it was taken The following simple explanation, borrowed from a neat writer and good photographer, shows what is meant at a glance If the original negative or print measures 1in. by 1in and the enlargement 2in by 2in, the former is said to be enlarged two diameters, or, to use another expression, four times superficially, from the fact that while the original contains but 1in superficial the enlargement contains 4in To find the superficial enlargement, multiply the number of the diameters by itself

There are various methods of enlargement, some slightly complicated, and requiring large and expensive apparatus, others quite simple, and calling for but little additional apparatus to those usually employed in everyday work I hardly think my readers will quarrel with me if I give preference to the latter class At the same time I trust to be able to give at least an outline of the less simple processes, if only as illustrations of the principles on which their practice is based

Direct Printing with the Solar Camera—The first method of enlarging that I shall describe is that in which a "solar camera," such as that figured in the accompanying illustration, is employed to produce an enlarged image on ordinary paper or carbon tissue. The principle is as follows A large plano-convex lens, say, of 9in. diameter, condenses the rays of the sun (which are, of course, parallel), and in the cone of rays formed by this condenser is placed the negative to be enlarged The objective or enlarging lens is situated in or near the focus of these rays, and at a distance suitable to the size

of enlargement required is fixed the frame to receive the sensitive paper or tissue In the apparatus shown in the illustration (kindly supplied by Mr J J Atkinson, of Manchester street, Liverpool, who manufactures these cameras, together with every other good variety of enlarging apparatus) these desiderata are all very neatly fulfilled The camera, moreover, is mounted on an axis which permits it to be pointed at the sun, and enables the operator to follow the earth's rotation with an accuracy sufficient for all practical purposes A more imposing form of this apparatus is one in which the camera with its condenser remains quite stationary, while the image of the sun is reflected on to the latter by a reflector, fitted with a clockwork

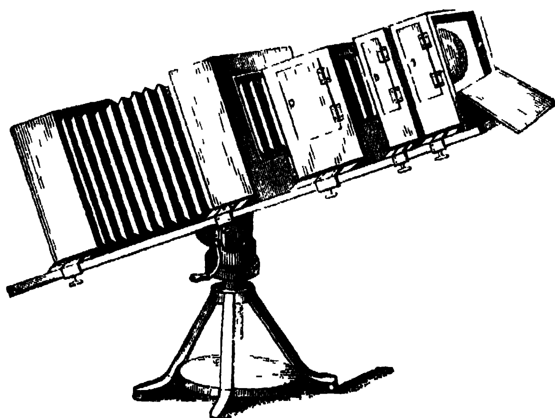


FIG. 8 ATKINSON'S SOLAR CAMERA

arrangement called a heliostat, which causes it to follow the sun automatically

It must be remarked that in these cameras the size of the condenser is an important element The larger its diameter, the greater the rapidity of exposure A diameter of 9in is about the least that can be employed with any success, but one of 14in is decidedly preferable

With the solar camera it will be found a great advantage to use carbon tissue in preference to silvered paper To understand this the reader should look back to the chapter on carbon printing, to the paragraph where the continuating action of light upon the exposed tissue is noticed As a matter of fact, a picture has been obtained by an exposure of two minutes, followed by a delay of two or three

days between the exposure and developement of the print, which would have required six times as long an exposure if the developement had been proceeded with immediately

I have not entered at any great length into the above system of enlargement by direct printing with the solar camera for two reasons partly because the principles involved, both optical and mechanical, are, generally speaking, so simple that little explanation is required, partly because, in spite of this fact, the apparatus necessary is so expensive that, practically, it is quite beyond the reach of all except wealthy amateurs or very large firms* where this class of work is made a speciality and carried on systematically to a very great extent indeed

One point, by the way, in favour of the solar camera is that, in bad weather, when direct printing on paper or tissue becomes impracticable, it may well be adapted to a method of enlarging from small negatives by developement, which I will now describe At the same time, it must not be thought that this latter system cannot be practised without a solar camera As will be shown, a much simpler and less costly apparatus can be devised to suit the purpose Still, it is as well to mention the fact that the solar camera is not restricted in its usefulness

By way of a small practical hint, it should be remembered that the frame to hold the negative should be made in such a manner as not to be affected by the great heat of the condensed rays, also that care be taken in removing the negative after an exposure, for reasons which the operator will best appreciate if he lays a negligent finger on the hot glass by way of experiment

Printing by Developement.—There are two methods of printing by developement, which, while about equally suited to the operations of enlarging, are at once simple and popular The essential difference is that in one the support of the sensitive surface is paper, in the other, glass I will take the method of enlarging upon negative paper first To begin with, an apparatus—adapted, by the way, to either process —will have to be constructed in the following simple manner. A small room is selected and darkened, with the exception of a small open frame capable of receiving the negative or negatives to be enlarged With a very moderate ingenuity an arrangement may be made in such a manner that negatives of different sizes may be framed at will We now have a room which is practically a gigantic camera, and into which the light only passes through the negative to be enlarged. Outside the frame or window a *radiating* surface, such as a sheet of white cardboard or opal glass, is arranged in such a manner as to radiate the pure light from the upper sky through the negative If my readers

will imagine the negative holder or frame to be a straight line, and will then draw another straight line from the lower end of the first, and making an angle of about 45 deg with it, they will easily understand my meaning Of course the second line represents the radiator, which may advantageously be hinged so as to fold up flush with the wall If cardboard be used as the radiator, it should be covered with glass to protect it from inclement weather Now let us turn to the inside of the room The first thing necessary is a table pushed up close to the wall in which is the negative holder On this the frame containing the lens will have to be worked The back of the lens, which may be an ordinary portrait combination (a quarter-plate lens being used for quarter-plate negatives, and so on), is pointed to the middle of the negative to be enlarged An arrangement must be made to allow the lens frame to be moved farther from or nearer to the negative, as required The construction of ordinary cameras will afford a guide Lastly, it is necessary to provide a third frame to hold the sensitive plate or paper during exposure A rough imitation of some form of a fire screen answers the purpose simply and satisfactorily The "apparatus" then comes to this there are three frames in a line, one, the negative frame, a stationary one, the other two movable Furthermore, there is an arrangement by which the light is radiated through two of the frames on to the third

The above being assumed to be in existence, we can now commence operations The negative to be enlarged is fixed in its frame, while on the frame shortly to hold the sensitive surface is pinned a piece of paper if negative paper is to be used, or a sheet of cardboard in the case of a sensitive glass plate To focus the enlargement, the lens frame and the frame supporting the surface are moved until the requisite degrees of sharpness and amplification (or reduction, by the way, for the apparatus fulfils either purpose) is secured There is a regular table for enlargement and reduction to be found at the end of the almanac published annually in connection with the *British Journal of Photography* All that is necessary is to know the number of times which it is desired to enlarge the original negative and the focal length of the lens On reference to the table it can be discovered at a glance what is the correct distance the sensitive plate must be from the centre of the lens, as well as the correct distance of the picture to be copied To borrow the stock example of the *British Journal of Photography*, let it be supposed that a photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of 6in , equivalent focus He must, therefore, look for four on the upper horizontal line of the table, and for six in the first vertical column, and carry his eye to where the line and the column

meet, which will be at a square space containing the figures, 30—7½ The greater of these indicates the distance the sensitive plate must be from the centre of the lens, the lesser, the distance of the picture to be copied To reduce a picture any given number of times, the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied, the lesser that between the lens and the sensitive plate

As regards the preparation of negative paper this, we believe, is obtainable ready salted from Mr J Solomon, of 23, Red Lion-square, at the rate of about 13s per quire If, however, the operator prefers to salt his own, he should select a stout sample of paper and sponge it with, or float it over, the following compound

SALTING SOLUTION

Iodide of potassium ..	80grs
Bromide of ammonium	35grs
Chloride of ammonium	10grs
Gelatine	60grs
Albumen	1oz
Water	10oz

In the foregoing formula, which is that used by Mr J Solomon himself, the gelatine is, as usual, dissolved by heat To sensitise the above salted paper, a flat board is covered with blotting paper, the salted paper superposed on the latter and treated with the following solution, a pool of which is poured out into the middle of the surface, and spread over it by means of a tuft of wool

SENSITISING SOLUTION

Nitrate of silver	1oz
Glacial acetic acid	½oz
Water ..	12oz

To effect the exposure, the focussing paper is unpinned and replaced by the sensitised paper, still wet, the cap, in the meantime, having been put upon the lens When everything is ready, the cap is removed, and, after a few seconds' exposure, replaced Then follows developement of the enlarged image, which is accomplished by the aid of the following solution, best used while warm, and advantageously supplemented by a few drops of the sensitising solution to impart vigour

DEVELOPER

Gallic acid	60gr.
Acetate of lead ...	10gr
Water ...	10oz

I now turn to the method of producing enlargements upon a sensitised glass plate, known generally as collodion transfers, from the fact that, on developement and fixation of the image upon glass, it is transferred to a more convenient support in the shape of paper

It may be premised that while, as before mentioned, the same apparatus may be used as in dealing with negatives, the successive operations, with some slight exceptions, are essentially identical The first difference occurs, in fact, in the actual preparation of the plate This is coated with a tough, horny, and extra bromised collodion It is then sensitised in a negative bath, the receptacle being, in cases of enlargements of good size, preferably one of the "wave" pattern, as catalogued and sold by almost every photographic dealer The image may be either developed with iron and subsequently blackened by a toning solution of chloride of gold, mercury, or platinum, or, to save the latter supplementary operation, developed simply with the following

DEVELOPER

Pyrogallic acid	100grs
Citric acid	60grs
Acetic acid	2oz
Water	20oz

Fixation with hyposulphite of soda follows

If a toning solution is used, its action should be ascertained by reference to the back of the plate and by inspecting the image by transmitted light

The transfer paper is prepared by floating a suitable sample upon a warm solution of

Gelatine	1oz
Water	10oz
Chrome alum	4oz

The last ingredient is added separately, being previously dissolved in a little warm water The gelatine solution will not keep, but the paper floated on it will do so well

To transfer the picture, which is supposed to be still wet after the washing out of the fixing salt, a piece of the dry transfer paper is soaked for about ten minutes in cold water until it is slimy to the touch It is now laid gelatine face downwards on to the collodion film and lightly pressed into contact therewith When dry it may be easily stripped from the glass, when the enlarged image will be found supported on the paper, and possessing a highly glossy surface This can be finished in oils without further preparation If a matt surface be desired the paper is stripped off the glass before it is quite dry, or if it has been allowed to dry, the same result may be obtained by leaving both glass and paper in water a short time before stripping.

For much assistance in placing the above methods fully and clearly before my readers I am indebted to an exhaustive article in the *British*

Journal of Photography Almanac for 1878, on the "Modern Practice of Enlarging," by Mr J Traill Taylor

Enlargement by Artificial Light —This method may be described as being extremely simple and convenient, while giving results which, if adequate care is taken, should rival those procurable by any other process of enlarging It may be practised in two different ways with two different ends in view First, when an extremely powerful light is used and it is desired to produce but one copy of the enlargement, secondly, when a less powerful and more easily accessible and manageable light is adopted with the object of producing an enlarged negative, from which, of course, any number of copies can be made at will

The best type of apparatus applicable to the first case is Solomon's Magnesium Light Enlarging Apparatus, which is certainly a most admirably contrived and efficacious machine It consists of a lantern resembling the ordinary optical or magic lanterns in vogue, and fitted with one of Solomon's clockwork magnesium lamps already alluded to in connection with photography by artificial light A chimney is also added to carry away the fumes of the combusted ribbon All that is necessary in using the apparatus is to place the lantern on a table or other suitable support, having at hand, meanwhile, a stand or frame to hold the plate or paper on which the enlargement can be projected Either of the two processes of negative paper or collodion transfer as just described under the heading of printing by developement may be used Now wind up the clockwork of the lamp, open the door of the lantern, set the clockwork in motion, and when the ribbon is about 1in. beyond the conductor stop the motion Place the negative in the orifice in front of the condenser and pin the focussing screen of paper or card upon the stand or frame, Light the lamp, close the door, and focus the picture Then stop the clockwork, place the cap on the lens, remove the focussing screen, and replace it by the sensitised glass or paper Relight the lamp, remove the cap from the lens, and expose according to the density of the negative From thirty to forty seconds will probably be about correct Developement proceeds as explained in the preceding section At the bottom of the lantern chimney is a removable tin cup, which should be kept nearly full of water. Into it fall the ashes of the burnt ribbon

The cost of an exposure at the present price of magnesium (about 12s. per oz.) is about 2d.

An apparatus (without lens, which can be of the ordinary portrait combination pattern) having 3½in. condenser, No 1 magnesium lamp, with roller, smoke tubes, elbows, semicircles, &c., is £5 10s. This is suitable for enlarging vignettes and most portrait negatives With 4½in condensers the apparatus cost £7 15s, with 6in, £10 10s.

In the second general method of producing enlargements by artificial light, the ordinary Sciopticon lantern is used This is fitted with a double or triple wicked paraffin lamp It is placed on a table or stand like the magnesium light apparatus, the frame to support the plate being also required as before Into the orifice in front of the condenser is slid a transparency from the negative to be enlarged After focussing, the cap is replaced on the lens, and a dry or wet plate, preferably the former, is substituted for the focussing screen Exposure, varying according to the density of the transparency and the kind of sensitive plate employed, follows, then developement and fixation in due course

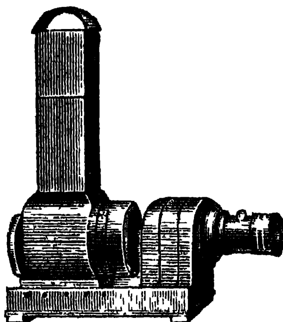


FIG 9 SCIOPTICON LANTERN

By turning the transparency round, a reverse enlarged negative can be obtained

An advantage of the above method is that there are three distinct opportunities for contributing improvement to the ultimate result The original negative may be retouched, then the transparency, and lastly the enlarged negative

The transparency may be produced by any of the methods described in the chapter devoted to that subject. Perhaps the carbon process, the special tissue being adopted, is to be recommended in preference to the others

Enlarging Apparatus —There are various kinds of complete enlarging apparatus in the market, by which enlargements may be secured with the least possible trouble and of great excellence. Amongst these may be mentioned Edwards' Enlarging and Copying Apparatus, which has been made the subject of a patent The price of one to enlarge from ¼ to ½ plate is £10 An extremely neat and efficient little machine, costing only 30s, is Hunter and Sand's (Cranbourne-street, Leicester-square) Copying and Enlarging Cone, which can be easily fitted to the front of almost any camera For neatness, efficiency, portability, and cheapness it deserves every recommendation



CHAPTER IX

Photo-Micrography

Before concluding this series, let me say just a very few words on the subject of photo-micrography, or the art of photographing the enlarged images obtained by the microscope I shall not stop long over this, for the thing is so simple and so easily managed in every way At the same time, I wish all my readers to understand that I do not any the less on this account encourage them to practise this most interesting branch of photography Indeed, I can recommend to them few better occupations for their evenings than to unite in this one study the benefits to be gained by the use of the microscope combined with the scientific wonders involved in that of the sensitive plate

All the apparatus required consists of a simple camera and a microscope, preferably one which will allow the tube to be turned back so as to be horizontal Otherwise some sort of framework must be made so as to facilitate the union of the microscope with the camera, which is managed by simply withdrawing the eye-piece of the former and introducing the tube into the camera front A temporary front may easily be screwed on to the camera so as to permit the junction of the microscope to it to be effected without any entrance of actinic light.

A low powered object glass is adapted, and an ordinary paraffin lamp arranged so as to duly light the object which may now be placed on the stage The reflector being adjusted, the image of the object may be carefully focussed on the screen, dimensions being regulated by increasing

distance between lens and focussing screen, and decreasing distance between lens and object

The focussing being accomplished, the screen is replaced by the dark slide containing a dry plate, which is exposed by drawing up the shutter, developed, &c , in the ordinary manner, and that is all

With the above I conclude the third and last part of "Practical Photography"



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